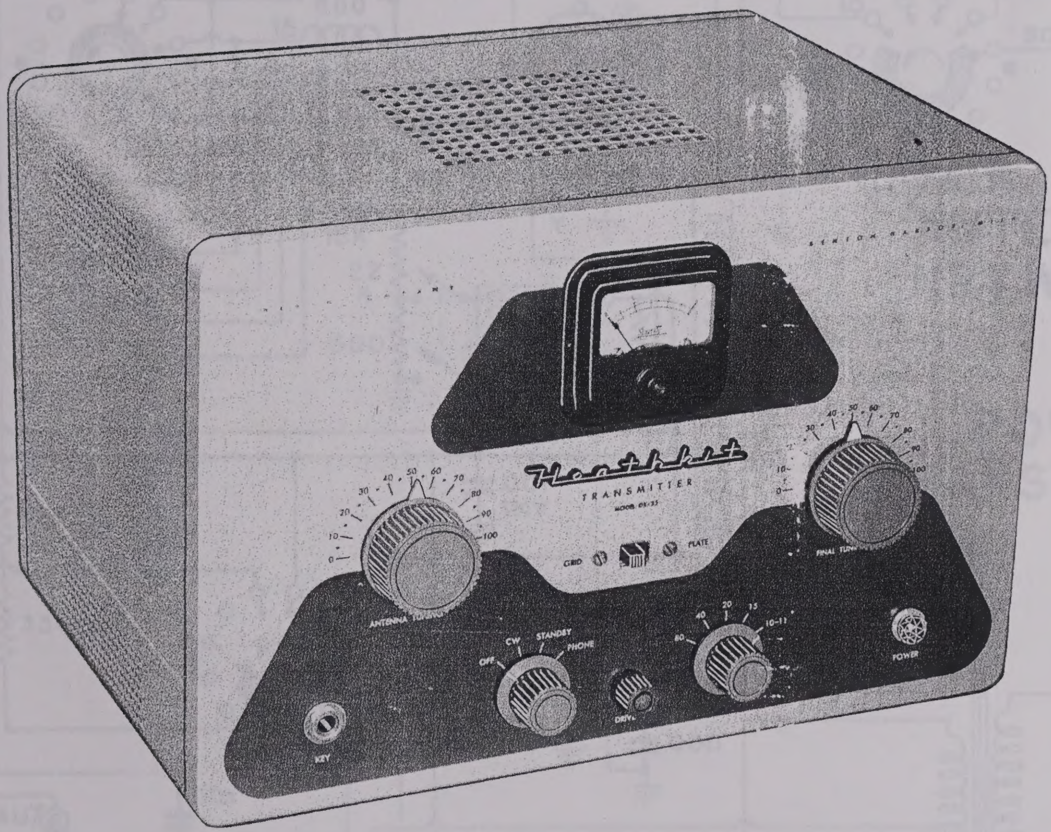
ASSEMBLY AND OPERATION OF THE HEATHKIT AMATEUR TRANSMITTER

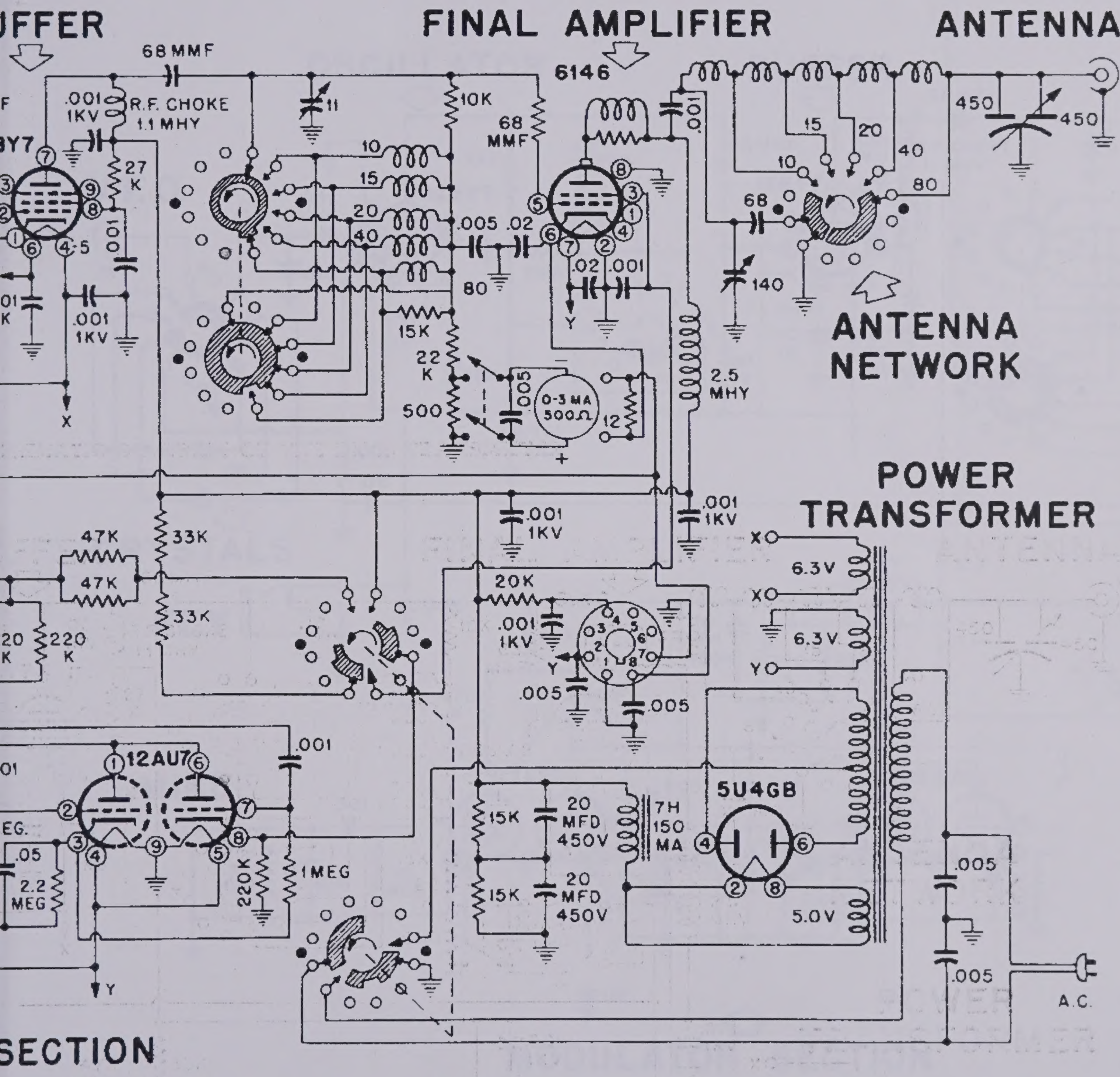
MODEL DX-35



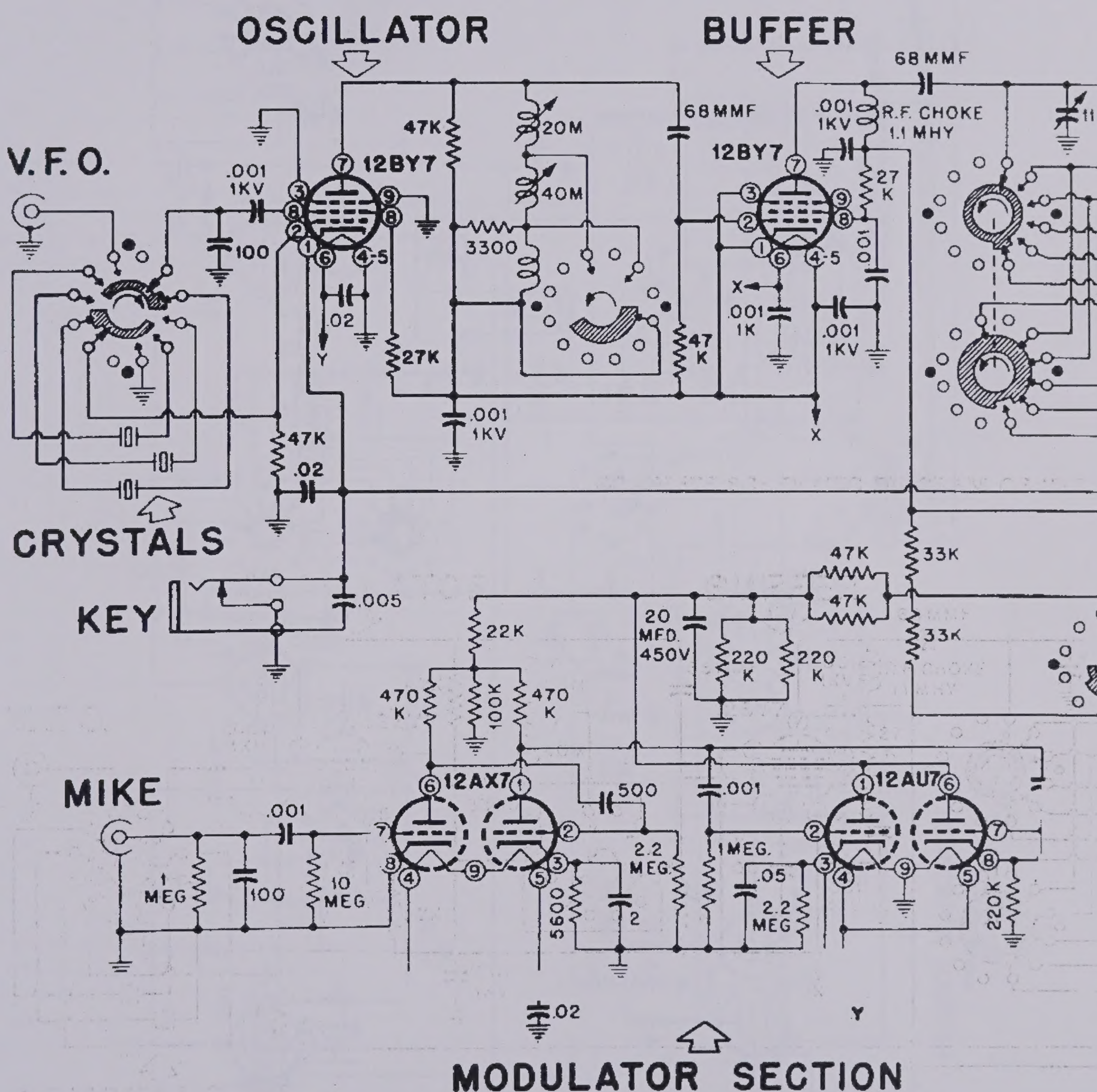
SPECIFICATIONS

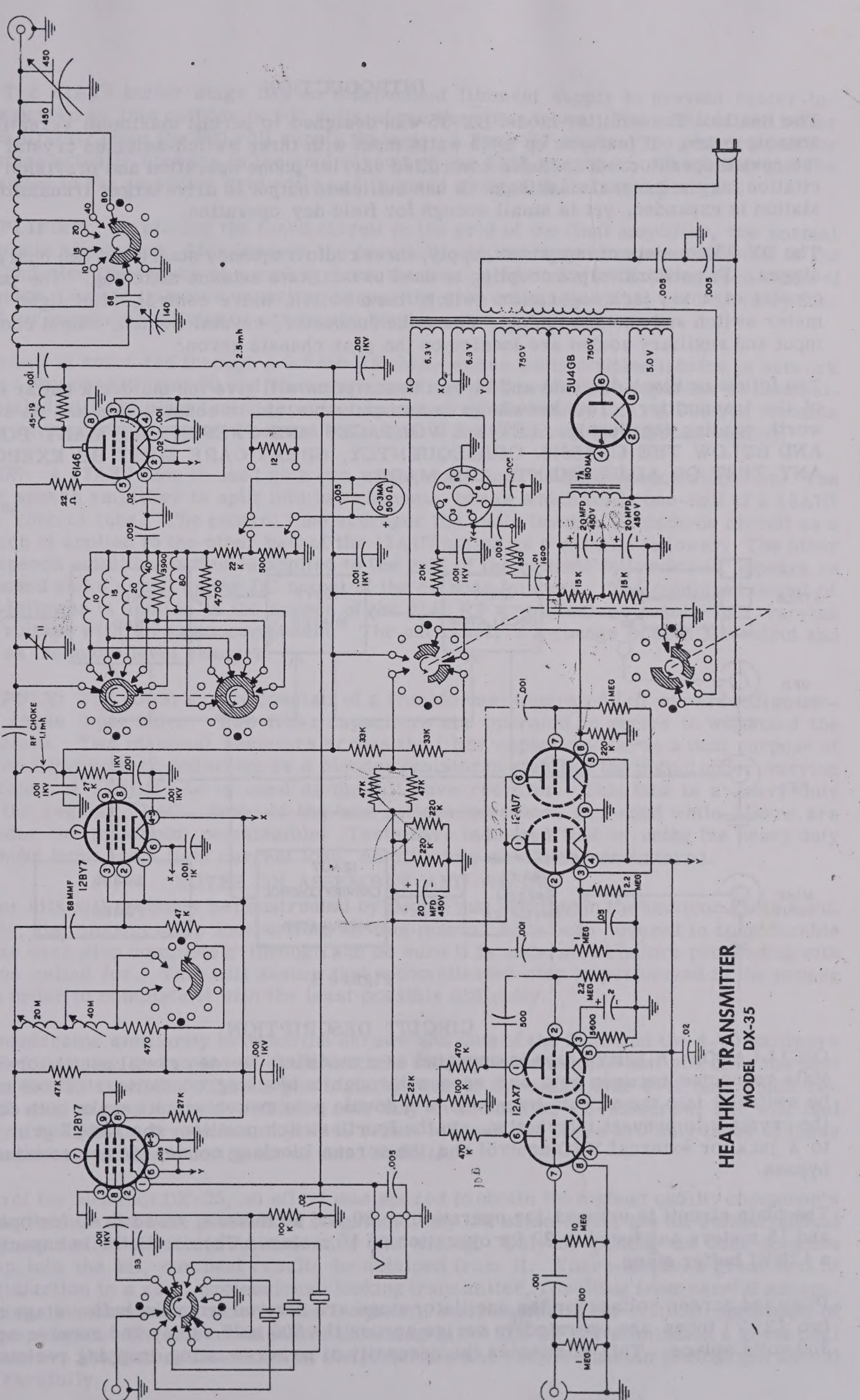
Power Input:................................	65 watt CW, 50 watt peak controlled carrier phone
Output Impedance:..........................	50-1000 Ω
Output Coupling:............................	Pi network (coaxial)
Operation:	Crystal-VFO, CW, Phone
Band Coverage:..............................	80, 40, 20, 15, 11, 10 meters
Tube Complement:...........................	5U4GB Rectifier
	12AX7 Speech Amplifier
	12AU7 Carrier Control, Modulator
	12BY7 Crystal Oscillator
	12BY7 Buffer
	6146 Final Amplifier
Power Requirements:........................	115 volts AC, 60 cycles, 175 watts
Cabinet Size:.................................	13" wide x 8 1/2" high x 9" deep
Net Weight:....................................	21 lbs.
Shipping Weight:.............................	26 lbs.

CHEMATIC DIAGRAM OF THE DX-35 TRANSMITTER



COMPLETE SCHEMATIC DIAGRAM OF THE





HEATHKIT TRANSMITTER
MODEL DX-35

INTRODUCTION

The Heathkit Transmitter model DX-35 was designed to permit maximum versatility at a reasonable price. It features up to 65 watts input with three switch-selected crystal positions for the novice operator. It includes controlled carrier phone operation and provision for VFO excitation for the general class ham. It has sufficient output to drive larger transmitters when the station is expanded, yet is small enough for field day operation.

The DX-35 consists of one power supply, three radio frequency stages and two dual purpose audio stages. Pi network output coupling is used to facilitate antenna matching. The panel controls consist of a key jack, operation switch, band switch, drive control, pilot light, final tuning, meter switch and antenna tuning. The mike connector, crystal switch, output connector, VFO input and auxiliary socket are located on the rear chassis apron.

The following block diagram and circuit description will give the builder a better understanding of the transmitter. This knowledge is an invaluable aid to construction and as such it is well worth reading thoroughly. LETHAL VOLTAGES ARE PRESENT AT MANY POINTS ABOVE AND BELOW THE CHASSIS. CONSEQUENTLY, GREAT CARE MUST BE EXERCISED WHEN ANY TEST OR ADJUSTMENTS ARE MADE.

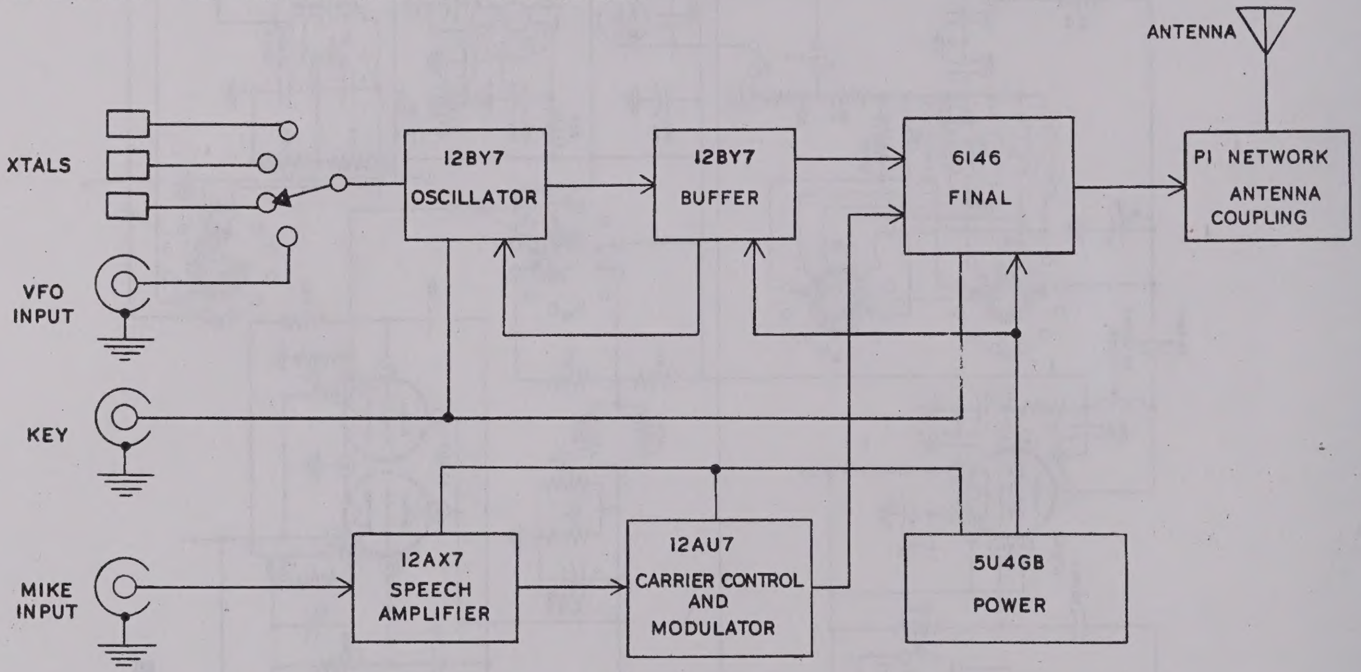


Figure 1

CIRCUIT DESCRIPTION

OSCILLATOR: A 12BY7 tube is operated as a modified Pierce crystal oscillator, with the crystals connected between grid and screen through a blocking condenser. Three crystals may be switched into the circuit by means of a double pole switch which breaks both connections to the crystals to prevent interaction. In the fourth switch position, the 12BY7 grid is connected to a jack for external VFO control and the screen blocking condenser is grounded for screen bypass.

The plate circuit is untuned for operation on 80 and 40 meters, tuned to 40 for operation on 20 and 15 meters and tuned to 20 for operation on 10 meters. The oscillator is capacity coupled to a 12BY7 buffer stage.

Plate and screen voltage for the oscillator stage are derived from the buffer stage cathode. The two 12BY7 tubes are operated in series across the 600 volt supply and receive approximately 300 volts apiece. This eliminates the necessity of power-wasting dropping resistors.

BUFFER: The 12BY7 buffer stage has an independent filament supply to prevent heater-to-cathode breakdown as this cathode is 300 volts above the other tubes. The plate of the buffer is shunt-fed directly from the 600 volt supply through a 1.1 mh RF choke. The plate circuit for the buffer stage actually appears in the grid circuit of the 6146 amplifier. The buffer plate is capacity coupled to the amplifier grid coils and is tuned along with the amplifier grid.

FINAL AMPLIFIER: By placing the tuned circuit in the grid of the final amplifier, the normal grid RF choke is eliminated. This lessens the possibility of low frequency parasitics due to the grid choke and also the chance of coupling from the final grid choke to the shunt feed choke of the buffer stage. An air trimmer capacitor across the grid coils adjusts the grid drive by tuning the grid for maximum efficiency across the band.

The plate circuit is shunt-fed through a 2.5 mh RF choke and capacity coupled into the pi network tank circuit. For operation at 80 and 40 meters, a 68 $\mu\mu$f 1000 volt fixed capacitor is automatically paralleled with the plate tuning capacitor by means of the bandswitch. A 900 $\mu\mu$f variable capacitor is permanently connected across the output of the pi circuit for antenna loading.

MODULATOR: A 12AX7 tube is used as a two-stage resistance coupled speech amplifier. The output of the speech amplifier is split into two channels, one of which feeds one-half of a 12AU7 acting as a control tube. The control tube averages the audio level in its cathode circuit as a DC bias which is applied to the other half of the 12AU7 acting as a cathode follower. The other half of the speech amplifier output is applied to the grid of the cathode follower and appears as a superimposed audio signal on the DC output of the cathode follower. The combined output of the cathode follower is applied to the screen of the 6146 RF amplifier and results in a varying DC screen voltage with an audio component. The net result is a change in both RF output and modulation as the audio level changes.

POWER SUPPLY: The power supply consists of a transformer-operated full wave rectifier circuit with a choke input filter. Two filter capacitors are operated in series to withstand the voltage involved. Two identical resistors across the filter capacitors serve a dual purpose of equalizing the filter voltage and acting as a bleeder resistor to stabilize the output under varying load conditions. A 5U4GB tube is used as the full wave rectifier. This tube is a heavy-duty version of the regular 5U4G. Some of the tube ratings have been exceeded while others are operated under the maximum permissible. Tests have indicated that by using the heavy duty tube with choke input and a light current load, no difficulty should be encountered.

NOTES ON ASSEMBLY AND WIRING

Many of these kits will probably be constructed by people just starting in the amateur radio field. Consequently, the step-by-step instructions in this manual have been covered in considerable detail. Read each step completely through and be sure it is understood before proceeding with the operation called for. This will assure that a complicated step is performed in the proper sequence in order to complete it with the least possible difficulty.

There is considerable similarity between the screws and nuts of the 3-48 and the 4-40 hardware supplied. Before using these pieces, examine them closely to determine that you have the part called for in the instructions. This is particularly true of the small size 4-40 nuts which resemble 3-48 nuts in physical size. These nuts may even hold on a 3-48 screw, but will feel loose. If any doubt exists, try the nut on a 4-40 screw to check it. There are only three of these and they should be used in mounting the crystal sockets.

In the design of the Heathkit DX-35, no effort was spared to obtain the highest quality components and assemble them in the best possible arrangement. By the same token, the kit builder should exercise a great deal of care during assembly and wiring. Only by putting the best possible workmanship into the kit, can best results be obtained from it. There is also a great deal of personal satisfaction in a neat, professional-looking transmitter, resulting from careful assembly and wiring. A common factor of radio frequency instruments is the critical placement of leads and components. The use of extensive shielding in the DX-35 has eliminated a great deal of this. However, the lead dress shown in the pictorials and bottom chassis photograph should be followed carefully.

This manual is supplied to assist you in every way to complete the DX-35 with the least possible chance for error. We suggest that you take a few minutes now and read the entire manual, omitting the step-by-step instructions, before any work is started. This will enable you to proceed with the work much faster when construction is begun. The large fold-in pictorials are handy to attach to the wall above your work space. Their use will greatly simplify the construction of the kit. These diagrams are repeated in smaller form within the manual. We suggest that you retain the manual in your files for future reference both in the use of the DX-35 and for its maintenance. During the initial testing of the transmitter, it will be out of its cabinet. REMEMBER THAT VOLTAGES DANGEROUS TO LIFE ARE PRESENT AT PRACTICALLY ALL POINTS ON THE CHASSIS.

NOTE: Sometimes the builder may find a place where it is difficult to hold a nut for assembly. Using long-nosed pliers, press a piece of solder across one side of the nut until the solder is forced part way into the threads. This will hold the nut and furnish a narrow handle useful for inserting the nut into tight places.

During the assembly and wiring procedure, a rag or some soft material should be placed over the work bench to prevent marring or scratching the chassis or component finish. Capacitors, resistors and transformers usually have leads longer than necessary to make the indicated connections. In the interest of both efficiency and appearance, the leads should be cut to an appropriate length before the connections are made.

In many cases, the specified wire lengths may seem long. These lengths were chosen so the wire could be run close to the chassis and formed for the best appearance. Marking the letters of the tube sockets and terminal strips on the chassis as they are installed will be a great help during the wiring procedure.

The actual tube markings may differ from the type specified in the parts list by an additional suffix (A, B, GT, etc.). This denotes a minor variation which will not affect the operation of the completed instrument.

In order to expedite delivery to you, we are occasionally forced to make minor substitutions of parts. Such substitutions are carefully checked before they are approved and the parts supplied will work satisfactorily. By checking the parts list for resistors, for example, you may find that a 2 KΩ resistor has been supplied in place of a 2.2 KΩ as shown in the parts list. These changes are self-evident and are mentioned here only to prevent confusion in checking the contents of your kit. We strongly urge that you follow the wiring and parts layout shown in the manual. The position of wires and parts is extremely critical in a stable transmitter and changes may seriously affect the characteristics of the circuit. Resistors and condensers generally have a tolerance rating of ±10% unless otherwise stated in the parts list. Therefore, a 100 KΩ resistor may test anywhere from 90 KΩ to 110 KΩ. The letter K is commonly used to designate a multiplier of 1000.

PROPER SOLDERING PROCEDURE

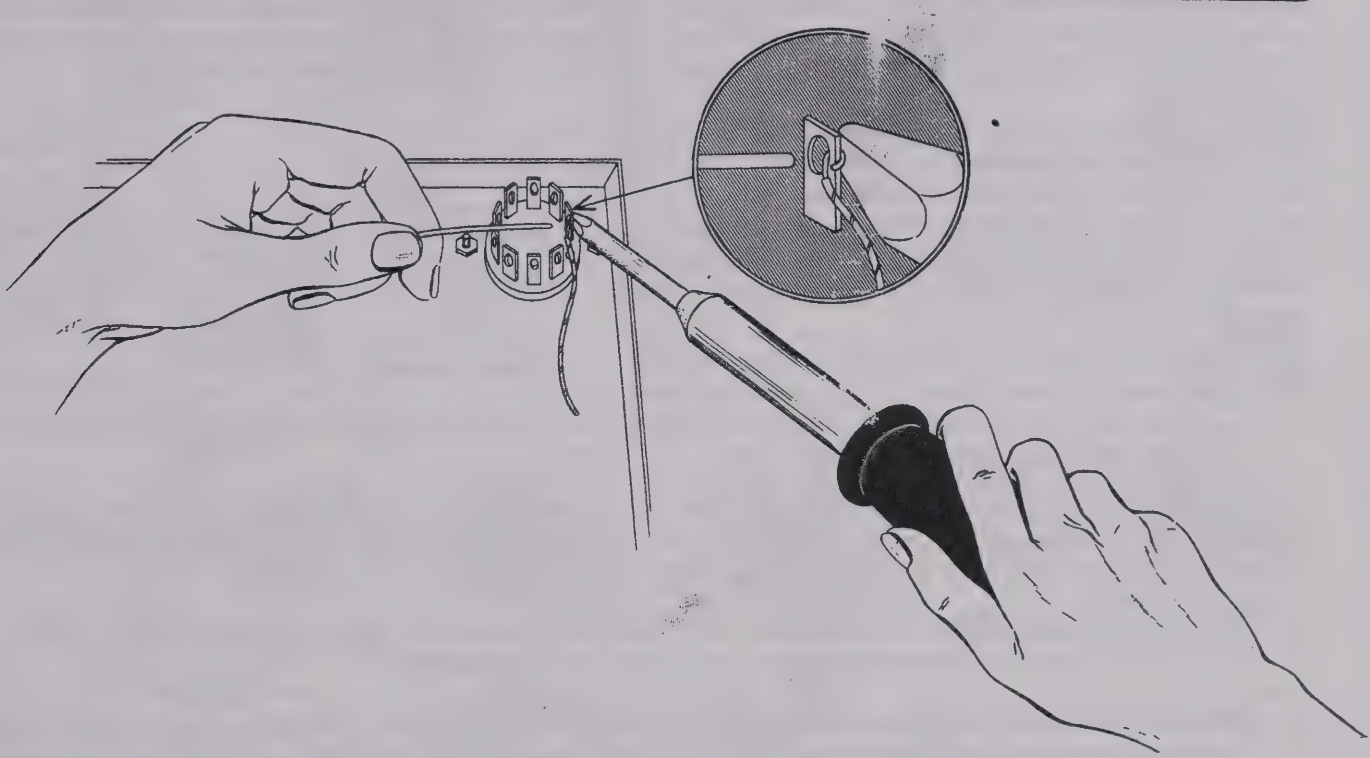
Only a small percentage of Heathkit purchasers find it necessary to return an instrument for factory service. Of these, by far the largest proportion function improperly due to poor or improper soldering.

Correct soldering technique is extremely important. Good solder joints are essential if the performance engineered into the kit is to be fully realized. If you are a beginner with no experience in soldering, a half-hour's practice with odd lengths of wire and a tube socket will be a worthwhile investment.

High quality solder of the proper grade is most important. There are several different brands of solder on the market, each clearly marked "Rosin Core Radio Solder." Such solders consist of an alloy of tin and lead, usually in the proportion of 50:50. Minor variations exist in the mixture such as 40:60, 45:55, etc. with the first figure indicating the tin content. Radio solders are formed with one or more tubular holes through the center. These holes are filled with a rosin compound which acts as a flux or cleaning agent during the soldering operation.

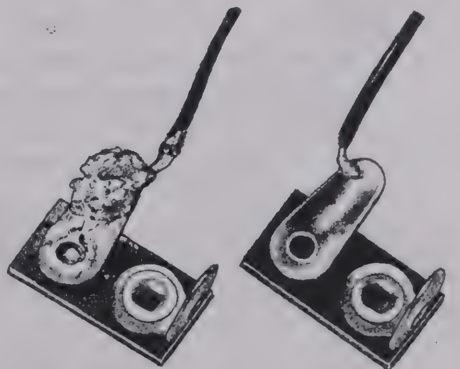
NO SEPARATE FLUX OR PASTE OF ANY KIND SHOULD BE USED. We specifically caution against the use of so-called "non-corrosive" pastes. Such compounds, although not corrosive at room temperatures, will form residues when heated. The residue is deposited on surrounding surfaces and attracts moisture. The resulting compound is not only corrosive but actually destroys the insulation value of non-conductors. Dust and dirt will tend to accumulate on these "bridges" and eventually will create erratic or degraded performance of the instrument.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.



If terminals are bright and clean and wires free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Crimp or otherwise secure the wire (or wires) to the terminal, so a good joint is made without relying on solder for physical strength. To make a good solder joint, the clean tip of the soldering iron should be placed against the joint to be soldered so that the terminal is heated sufficiently to melt solder. The solder is then placed against both the terminal and the tip of the iron and will immediately flow out over the joint. Refer to the sketch below. Use only enough solder to cover wires at the junction; it is not necessary to fill the entire hole in the terminal with solder. Excess solder may flow into tube socket contacts, ruining the socket, or it may creep into switch contacts and destroy their spring action. Position the work so that gravity tends to keep the solder where you want it.

A poor solder joint will usually be indicated by its appearance. The solder will stand up in a blob on top of the connection, with no evidence of flowing out caused by actual "wetting" of the contact. A crystalline or grainy texture on the solder surface, caused by movement of the joint before it solidified is another evidence of a "cold" connection. In either event, reheat the joint until the solder flows smoothly over the entire junction, cooling to a smooth, bright appearance. Photographs in the adjoining picture clearly indicate these two characteristics.



A good, clean, well-tinned soldering iron is also important to obtain consistently perfect connections. For most wiring, a 60 or 100 watt iron, or the equivalent in a soldering gun, is very satisfactory. Smaller irons generally will not heat the connections enough to flow the solder smoothly over the joint and are recommended only for light work, such as on etched circuit boards, etc. Keep the iron tip clean and bright. A pad of steel wool may be used to wipe the tip occasionally during use.

Take these precautions and use reasonable care during assembly of the kit. This will insure the wonderful satisfaction of having the instrument operate perfectly the first time it is turned on.

ASSEMBLY AND WIRING

(S) means solder. (NS) means do not solder yet.

NOTE: If color codes on mica capacitors are specified in the instructions, only the significant colors will be given. Silver mica capacitors have red cases and ordinary mica capacitors have brown cases. Illustrations of the components used in this kit are given on Page 35.

NOTE: On miniature sockets, the numbering of the socket is determined by starting clockwise from the left of the blank terminal space. On octal sockets, the numbering is determined in the same way from the keyway. All sockets are numbered from the bottom chassis view. See Figure 2.

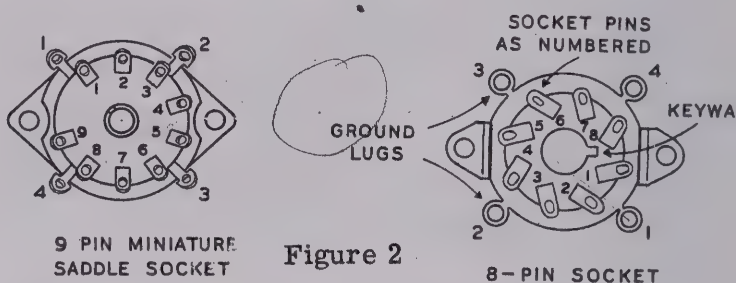


Figure 2

( ) Mount the three crystal sockets directly behind hole D, using the 1/2" long 4-40 screws and the small 4-40 nuts. Do not force the sockets or tighten the screws to extremes or the sockets may be broken.

( ) Mount a 9-pin miniature shielded socket at hole A, positioning as shown in Figure 3 on Page 8. (This is the socket with the metal cap which mounts from the top of the chassis). Use 3-48 screws and nuts with #3 lockwashers under the nut.

( ) Mount a regular 9-pin miniature socket at hole B using the same hardware and position as shown. This socket mounts from the bottom of the chassis.

( ) Mount 9-pin miniature sockets at holes C and D using the same hardware and positioning the pins as shown in Figure 3. Check the pin locations on the four sockets just mounted before proceeding further.

( ) Mount an octal socket at hole E with the keyway (between pins 1 and 8) toward the chassis center. Use 1/4" x 6-32 screws with lockwashers under the nuts.

( ) Mount an octal socket and a 4-lug terminal strip AA at hole F on the rear chassis apron. Observe the position of the keyway and use only one mounting screw at this time. See Figure 3. Insert the mounting screw from the outside through the chassis hole nearest the right edge, then through the tube socket flange, through the terminal strip and a lockwasher. Secure with a 6-32 nut.

( ) Mount the phono socket at hole G, using 6-32 x 1/4" screws, lockwashers and nuts.

( ) Mount the crystal switch at hole H using a 3/8" lockwasher on the inside of the chassis and a 3/8" flat washer and nut on the outside. Position the switch so the contacts appear as shown in Figure 3.

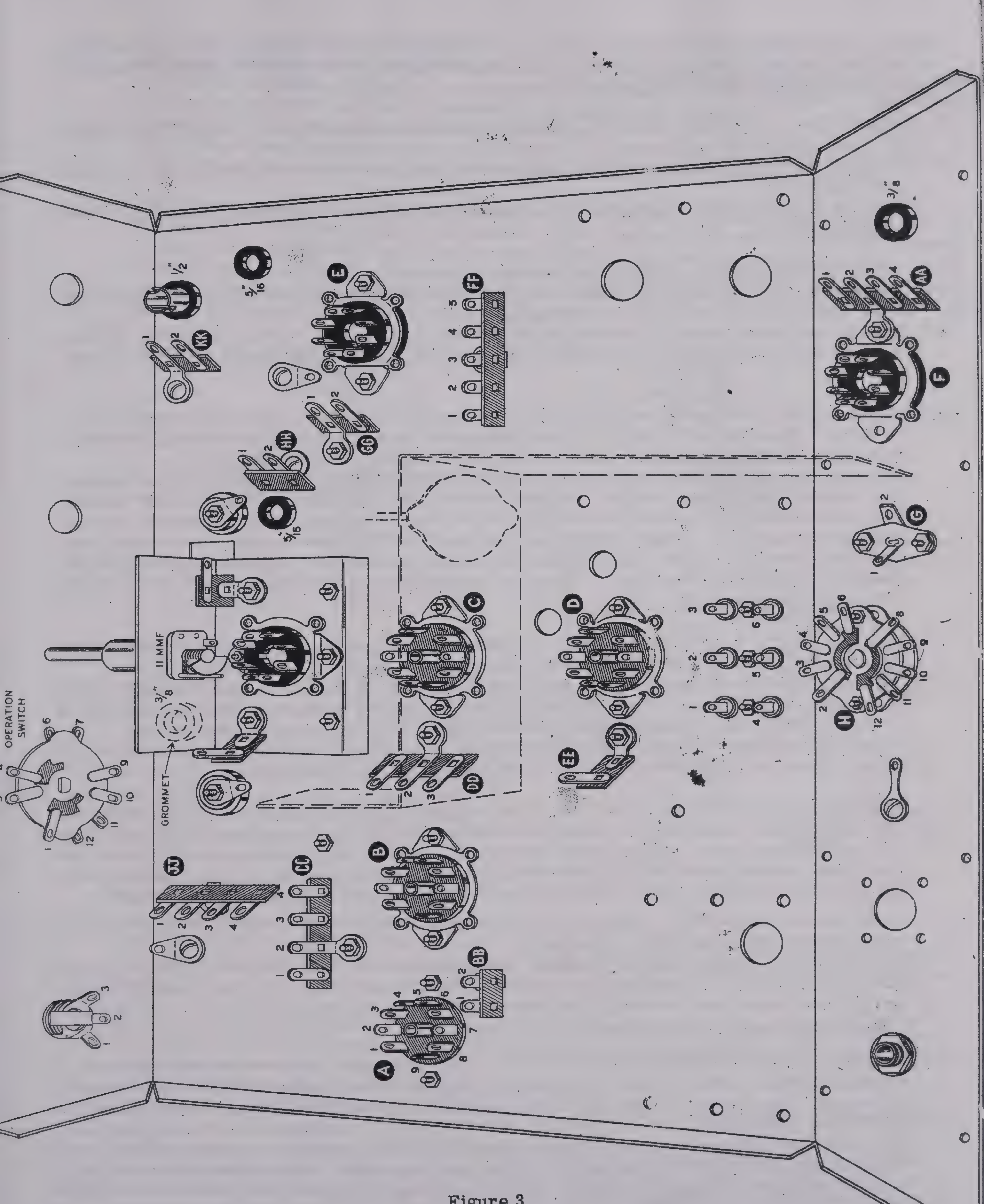


Figure 3

NOTE: In mounting terminal strips,. place an additional lockwasher between the terminal strip foot and the chassis. This prevents the strip from turning and assures a good ground connection for the grounded lug of the terminal strip.

( ) Between sockets A and B, mount 2- and 4-lug terminal strips BB and CC as shown in Figure 3. Use 6-32 x 1/4" hardware.
( ) Mount a 3-lug terminal strip DD at the nearest hole to the left of socket C, using 6-32 x 1/4" hardware.
( ) Mount a 1-lug terminal strip EE at the nearest hole to the left of socket D using the same hardware.

( ) Mount a 5-lug terminal strip FF at the rear of socket E.
( ) Examine Figure 3 closely and insert two 3/8" rubber grommets, one 1/2" grommet and two 5/16" grommets in the positions shown.
( ) Identify final tube mounting bracket and mount the 11 $\mu\mu$f midget variable capacitor through the 1/4" hole on the front of the bracket. Position the capacitor terminals as shown in Figure 3.

( ) Mount an octal tube socket on the bracket with the keyway toward the variable capacitor.
( ) Install a 6-32 set screw in the 3/16" shaft extension and slip the extension through the small hole in the middle of the front chassis apron on the inside. See Figure 3.
( ) Note the four small holes surrounding the large round chassis hole. Using the two nearest the chassis front, insert 6-32 x 1" screws through the chassis top. Place the 3/4" spacers over these screws and mount the tube bracket so the screws pass through the holes nearest the variable capacitor. Place 1-lug terminal strips with lockwashers under the mounting feet over the screws and tighten just sufficiently to hold the assembly in place with the terminal strips facing as shown in Figure 3. Omit the lockwashers under the nuts as the screw length will not permit them.

( ) Now insert 1" x 6-32 screws through the remaining two holes in the chasses and bracket, omitting the spacers. Use lockwashers and nuts to hold, but do not tighten.
( ) Carefully align the midget variable capacitor shaft with the extension shaft coming through the front chassis apron. Tighten the 6-32 set screw and make sure the capacitor can be rotated freely. Now tighten the four screws holding the tube mounting bracket.
( ) Referring to Figure 3 and Pictorial 3 on Page 22, work the pilot light socket through the 1/2" rubber grommet. Position the socket terminals as shown in Pictorial 3.

( ) Mount spade screws on the front side of the final shield plate using 1/4" x 6-32 hardware. The shield plate is mounted on top of the chassis using the two holes about 2 1/2" on either side of the large hole. On the under side of the chassis, use a lockwasher and nut on the spade bolt nearest socket B. On the remaining spade screw, mount a 2-lug terminal strip GG with the lockwasher under the mounting foot and one under the nut. See Figure 3.
( ) Cut a piece of red wire 2" long and strip both ends, connect one end to the bottom terminal of the 2.5 mh RF choke (NS).
( ) Cut one lead of a .001 μfd 1000 v. disc ceramic capacitor to 1" and connect to the same choke terminal (S). In mounting the choke the red lead passes through the nearby grommet and the .001 capacitor free end is connected to the rotor terminal of the 140 $\mu\mu$f variable tuning capacitor (S). See Pictorial 3.

( ) Mount the 2.5 mh RF choke on the chassis top. See Pictorial 3 for position and direction of choke terminals. Mount a 2-lug terminal strip HH under the chassis using the same mounting screw. See Figure 3. The mounting is accomplished in the following order. A 6-32 x 1/2" screw passes through a lockwasher, terminal strip foot, another lockwasher, the chassis, a #6 fiber washer, and the threaded base of the RF choke in that order. Again, care must be exerted to prevent damage to the ceramic material. By inserting your left forefinger through the rectangular chassis hole from above, it is possible to hold both the choke and the terminal strip in place for tightening.

( ) Refer to Figure 3 and Pictorial 3 and mount two feed-through insulators through the two 5/16" holes on either side of the rectangular front chassis hole. The gaskets furnished with the insulators should be placed between the insulator and the chassis on both sides. The longer side of the insulator is on top of the chassis.

( ) Using the nuts and washers furnished with the insulators, mount #6 solder lugs on both terminals of each insulator and position the lugs as shown in the respective figures.

( ) Mount the 2-section variable loading capacitor on top of the chassis in the position shown in Pictorial 3. Refer to Figure 3 and mount a solder lug under the chassis using the screw closest to the chassis edge and a lockwasher on the screw closest to the chassis front. Mount a 4-lug terminal strip JJ at the remaining hole with a lockwasher between the terminal strip and the chassis only. Use 1/4" x 6-32 hardware and align the capacitor squarely with the chassis front edge before tightening the screws.

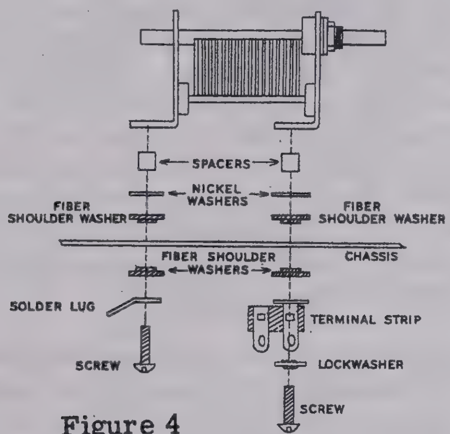


Figure 4

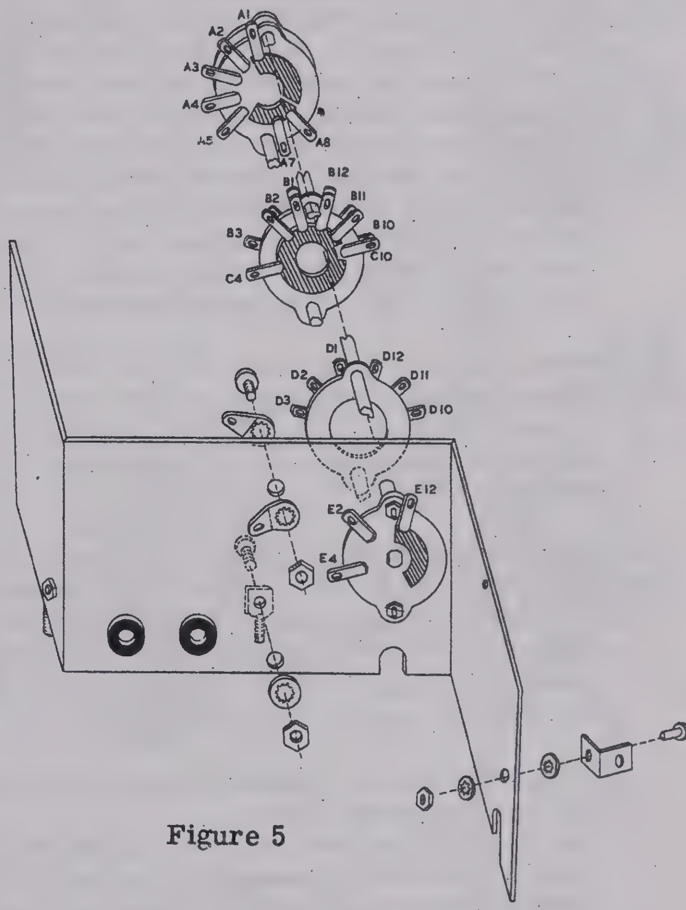


Figure 5

( ) The plate tuning capacitor is mounted on the opposite side at the front of the chassis, using the two 7/32" holes. 6-32 x 1/2" screws, #6 flat washers, insulating shoulder washers and 3/16" spacers are used. The method of assembly is shown in Figure 4 above. On the screw near the front of the chassis, place a lockwasher under the screw head and mount a 2-lug terminal strip KK under the chassis. On the rear screw, mount a solder lug under the chassis. Position as shown in Figure 3. Align the capacitor square with the chassis before tightening the screws. On the capacitor itself, remove the two washers furnished on the capacitor shaft bushing, but replace the nut; it will be used later to hold the panel.

( ) Refer to Figure 5 and identify the bandswitch and the switch mounting bracket. On the mounting bracket, install the spade bolts on the side and place as shown using 1/4" x 6-32 screws with lockwashers under the nut.

( ) Insert two 5/16" rubber grommets in the 5/16" holes.

( ) Using the hole near the top center of the bracket, install a #6 solder lug on each side of the piece.

( ) Position the lugs as shown and secure using 6-32 x 1/4" hardware without a lockwasher.

( ) Mount the small angle bracket using the hole at the end center. Insert a 6-32 x 1/4" screw through the unthreaded side of the angle bracket, through a lockwasher, the mounting bracket another lockwasher and a nut. Align the angle square and flush with the edge of the aluminum and tighten.

( ) Examine the bandswitch carefully and you will note that there are nuts following both the third and fourth switch decks. This allows the fourth deck to be removed without disturbing the rest of the switch. Now carefully examine the spacers, insulating washers and the fourth switch deck as to position of spacers, washers, switch contacts and switch rotor. It would pay to make a rough sketch of this. Remove the last nuts on the switch and remove the assembly up to the next set of nuts, but do not touch these. Again refer to Figure 5 and slip the threaded studs of the switch through the two small holes in the switch mounting bracket from the side shown. Be sure the switch contacts appear as shown in the figure. Reassemble the back switch section on the rear of the mounting bracket in the same position and order that it was originally.

( ) Some careful manipulation will be necessary to mount the bandswitch assembly. Refer to Pictorial 2 on Page 20 which shows the switch in place. This will acquaint you with the proper hole in the panel apron and the placement of the switch mounting bracket. Slip the 3/8" lockwasher over the switch bushing, then with the rear of the chassis toward you, start the switch toward the correct hole in the front chassis apron. The trailing edge of the switch mounting bracket should be toward the right and tilted upward. When the rear edge of the switch bracket is aligned with the right rear chassis corner at about a 20° angle, the front of the switch will slip into the front chassis hole until the ceramic switch wafer is forward of the final tube mounting bracket. At this stage, bring the rear of the switch to the left, while still maintaining the upward tilt. With the assembly centered along the chassis axis, carefully start the mounting bracket downward into the chassis until the two spade bolts pass through the chassis holes. The small angle bracket should lie on top of the octal socket foot. Do not secure the bracket or switch at this time.

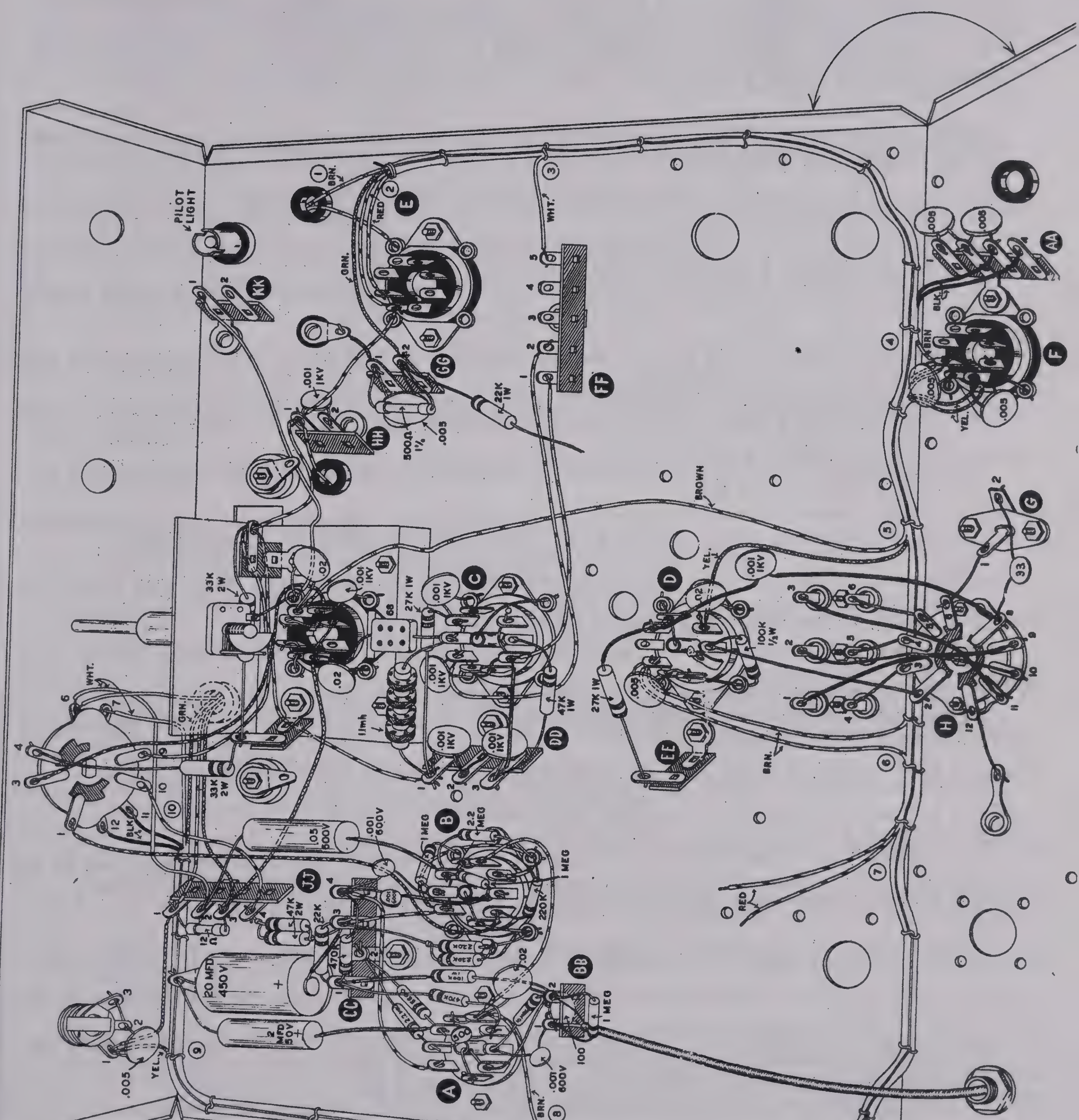
( ) With a pencil, draw a line on the under side of the chassis by tracing completely around the switch bracket. Also indicate the cutout arches in the switch bracket. This indicates the limits in which future wiring must be confined and where cable or other wiring will pass through the switch bracket. Carefully memorize the bracket and switch wafer positions for future reference.

( ) The oscillator compartment shield consists of a thin aluminum right angle with one long and one short bend, having 5/32" holes. Using the hole on the long bend, mount a 6-32 spade bolt from the inside as defined by the bends.
( ) This shield fits between the switch bracket and the rear chassis apron with the short bend passing over the switch bracket at the right side and the spade bolt on the long end passing through the appropriate chassis hole.

( ) Place the shield in position and trace around the side contacting the chassis. Also mark the cutout slot for wires.
( ) Familiarize yourself with the layout including the cutout points for wires to enter or leave the compartments formed by the switch bracket and oscillator shield. Be sure the space enclosed by these units have been marked on the chassis and make a rough sketch on Figure 3 of the switch wafer positions. Then remove both assemblies.

( ) Mount the operation switch on the front chassis apron and position as shown in Figure 3, using the switch contacts as a reference point. Place a lockwasher behind the chassis apron and a flat washer and nut in front. Tighten nut just sufficiently to hold for wiring.
( ) Mount and position the key jack as shown using the same hardware. Tighten in the same manner.

NOTE: Wiring on tube sockets will be designated by the letter used in mounting the socket and the pin number. For example, C4 will refer to the #4 pin counted in a clockwise direction on socket C. Refer back to Figure 2. When a length of wire is called out in the instructions, it will mean the total length before stripping the end. Unless otherwise specified, normal stripping length should be approximately 1/4" for tube socket connections and 5/16" length for terminal strips. Wherever there is danger of component leads shorting to the chassis, you will find the phrase "use sleeving," usually with the specified length. This is the black insulating material which is made to slip over bare wires or leads to give them insulating qualities.



PICTORIAL 1

( ) Install the cable as shown in Pictorial 1 on Page 12, the single brown wire at one end passes through the 5/16" grommet at the rear of the pilot light. This is point ① of the cable. The green wire at the other end passes through the 3/8" grommet near the operation switch. This is point ⑩ of the cable. The cable should follow the chassis edge and stay well to the rear of the crystal sockets.

NOTE: In the cable, the green wire is the final grid meter lead. The black wires are AC line, the brown wires filament supply, the red wire B+, the yellow wire cathode and the white wire B-.

( ) On top of the chassis, connect the brown wire to terminal 2 of the pilot light. See Pictorial 3. Solder this connection.
( ) Cut a brown wire to 3 7/8" length and strip 5/16" of insulation from both ends. Connect one end to terminal 1 of the pilot light (S).
( ) Run the other end through the 5/16" grommet and connect to ground lug #2 of socket E (NS).
( ) At point ② of the cable, connect the green wire to GG2 (NS).

( ) Cut both leads of a .005 μfd disc ceramic capacitor to 1/2" length. Connect one lead to GG1 (NS) and the other to GG2 (NS).
( ) Cut both leads of a 500 Ω precision resistor 5/8" long. Connect it from GG1 (NS) to GG2 (NS). In making this connection, space the resistor at least 3/8" from the terminal to prevent overheating during soldering.
( ) Cut one lead of a 22 KΩ 1 watt resistor (red-red-orange) to 7/8" and connect to GG2 (S). Leave the other end free.
( ) Connect a bare wire to GG1 (S). Slip a 1 1/8" length of sleeving over the wire and connect to the solder lug just in front of socket E (S). Run the wire close to the chassis.

( ) Connect either red wire at point ② of the cable to E1 (NS) and the other to E2 (NS). Use the terminal holes nearest to the socket.
( ) Connect the white wire at point ③ of the cable to FF5 (NS).
( ) Connect either black wire at point ④ of the cable to AA3 (NS) and the other wire to AA4 (NS). See Pictorial 1.
( ) Cut one lead of a .005 μfd disc ceramic capacitor to 1/2" and the other lead to 3/8".
( ) Connect the 1/2" lead to AA2 (NS) and the 3/8" lead to AA1 (NS). Arrange the capacitor to clear the 3/8" grommet.
( ) Cut one lead of a .005 μfd disc ceramic capacitor to 1/2" and the other lead to 3/8".
( ) Connect the 1/2" lead to AA2 (S) and the 3/8' lead to AA3 (NS).
( ) Connect both yellow wires at point ④ of the cable to F8 (NS).
( ) Connect a short bare wire from F7 (NS) to the adjacent ground lug (S).
( ) Cut both lead of the .005 μfd disc ceramic capacitor to 3/8" length and connect from F8 (S) to F7 (S). Position the capacitor to clear the switch bracket which is mounted later.
( ) Connect a short bare wire from F1 (NS) to the adjacent ground lug (S).

( ) Connect the three brown wires at point ④ of the cable to F2 (NS). Use the terminal hole nearest the socket.
( ) Cut both leads of a .005 μfd disc ceramic capacitor to 3/8" lengths and connect from F1 (S) to F2 (NS).
( ) Refer to the crystal switch. Connect a bare wire from H3 (S) to crystal socket terminal 4 (S).
( ) Connect a bare wire from H4 (S) to crystal terminal 5 (S).
( ) Connect a bare wire from H5 (S) to crystal terminal 6 (S).
( ) Connect a bare wire from H6 (S) to G1 (S).

( ) Insert a bare wire through H9, slip a 1 3/4" length of sleeving over it and connect to crystal terminal 1. Solder both connections.
( ) Connect a bare wire from H10 (S) to crystal terminal 2(S). Do not use sleeving, but run this wire over the one just installed to isolate it from the switch.
( ) Install a bare wire through H11, slip a 1 3/4" length of sleeving over it and connect to crystal terminal 3. Run this wire over the last one and solder both connections.
( ) Connect a bare wire from H12 (S) to the adjacent solder lug (S).

( ) Between points 4 and 5 of the cable, bend a slight hump in the cable so that it can pass through the hole in the switch bracket which was previously marked on the chassis. Also bend humps in the cable at the three other points where the small holes are in the rear chassis apron. This is done so the cable will clear the sheet metal screws used to secure the chassis to the cabinet. See Pictorial 1. On either side of these humps the cable should lie close against the chassis rear apron.

( ) Cut one lead of a .02 μfd disc ceramic capacitor to 5/16" length and the other lead to 7/16".
( ) Connect the 5/16" lead to the #1 ground lug of socket D (S) and the other lead to D1 (NS). Mount the capacitor perpendicular to the chassis. See Pictorial 1.
( ) Connect the yellow wire at point 5 of the cable to D1 (S). Run the wire as shown in Pictorial 1.
( ) The brown wire at point 5 of the cable is extended toward the final amplifier tube bracket but not connected. It will later pass through the hole in the switch bracket at the point previously marked.

( ) Connect the two brown wires at point 6 of the cable to D6 (NS). Arrange the wires to clear the crystal socket. See Pictorial 1.
( ) Bend pin 3 of socket D against the socket center ground post to be soldered later.
( ) Cut one lead of a 100 KΩ 1/2 watt resistor (yellow-violet-orange) to 7/8" and the other lead to 3/8".
( ) Insert the 7/8" lead upward through the #2 ground lug of socket D to D4. Solder the ground lug only.

( ) Connect the 3/8" resistor lead to D2 (NS).
( ) Cut one lead of a .005 μfd disc ceramic capacitor to 5/16" length and the other lead to 1/2".
( ) Run the 1/2" lead through D5 (S) to D4 (S).
( ) Connect the 5/16" lead to D6 (S).
( ) Slip a bare wire through D2 and connect to H2. Run the wire over the insulated wire from H9. Solder both connections.

( ) Run a bare wire through the socket center post, through pin 9 to the #4 ground lug. Solder all three connections and also the #3 terminal which was bent against the center post.
( ) Connect a 33 $\mu\mu$f disc ceramic capacitor from the ground lug of VFO socket G (S) to crystal switch terminal 8 (NS).
( ) Cut one lead of a .001 μfd 1 kv disc ceramic capacitor to 7/8" and slip a 5/8" length of sleeving over the lead. Connect this lead to D8 (NS).

( ) Slip a 7/8" length of sleeving over the other capacitor lead and connect it to H8. Cut off the excess lead and solder.
( ) Cut one lead of a 27 KΩ 1 watt resistor (red-violet-orange) to 1/2" length and the other lead to 1". Slip a 3/4" length of sleeving over the 1" lead and bend to a right angle 1/2" from the end.
( ) Connect the 1/2" lead to terminal strip EE (NS) and the bent lead to D8 (S). Be sure D8 clears D7 and D9.

( ) At point 8 of the cable, connect the brown wire through A5 (NS) to A4 (S).
( ) At point 9 of the cable, connect the yellow wire to terminal 1 of the phone jack (NS).
( ) Cut a piece of yellow wire to a length of 5 1/4" and strip both ends. Shape the wire to run as shown in Pictorial 1. Connect one end to the phone jack terminal 1 (NS) and the other end to JJ1 (NS).

( ) Cut one lead of a .005 μfd disc ceramic capacitor to 3/8" and the other lead to 7/8". Connect the 3/8" lead to phone jack terminal 1 (S). Run the other lead through terminal 2 to terminal 3 and solder both terminals.
( ) At point 10 of the cable, connect either black wire to terminal 11 of the operate switch (S).
( ) Connect the other black wire to switch terminal 12 (S).
( ) Connect the white wire at point 10 of the cable to switch terminal 7 (S).

NOTE: In wiring the buffer stage, remember that all of the components must lie well within the line traced around the switch bracket.

( ) Cut both leads of a .001 μfd 1 kv disc ceramic capacitor to 1/2". Connect one lead to DD1 (NS) and the other lead to DD2 (NS).
( ) Cut both leads of a .001 μfd 1 kv disc ceramic capacitor to 1/2". Connect one lead to DD2 (S) and the other lead to DD3 (NS).
( ) Cut both leads of a .001 μfd 1 kv disc ceramic capacitor to 3/8". Connect one lead to C6 (NS) and the other lead to #3 ground lug (S).

( ) Cut a piece of brown wire to a length of 6" and strip both ends. Connect one end to C6 (S) and the other end to FF2 (NS). Run the wire as shown in Pictorial 1.
( ) Cut a piece of brown wire 4 7/8" long. Strip one end 9/16" and the other end 5/16".
( ) Run the long bare end through C3 and C4 to C5. Solder C4 and C5 only.
( ) Insert a bare wire through DD3 and slip a 3/4" length of sleeving over it. Continue the wire through C3 to C1 and form the wire to clear C2 and the socket center post. Solder C3 and C1 only. See Pictorial 1.

( ) Connect the other end of the 4 7/8" brown wire to FF1 (NS).
( ) Connect a 47 KΩ 1 watt resistor (yellow-violet-orange) between DD3 (NS) and C2 (NS).
( ) Connect a short bare wire from the socket center post (S) to #1 ground lug (S). Arrange to clear all other connections.
( ) Cut both leads of a .001 μfd 1 kv disc ceramic capacitor to 3/8". Connect one lead to the #4 ground lug (S) and the other lead to C8 (NS).

( ) Connect a 27 KΩ 1 watt resistor (red-violet-orange) between DD1 (NS) and C8 (S). See Pictorial 1 for resistor position.
( ) Cut one lead of a 68 $\mu\mu$f 1000 volt silver mica capacitor to 1/2" and connect to C7 (NS). Leave the other end free.
( ) Cut both leads of a 1.1 mh 4 pi RF choke to 3/4" and bend at right angles. Bend the leads toward the notches in the choke form to prevent wire breakage.

( ) Connect one lead to C7 (S) and the other lead to DD1 (NS). The choke should run horizontal to the chassis and about 1" above it.
( ) Examine the work just completed and make sure all connections clear each other. Even the filament connections in this stage are 300 volts positive, so care must be taken to prevent short circuits at all points.
( ) Cut a piece of red wire to 5 3/4" length and strip both ends. Connect one end to DD1 (S). Run the wire over the final tube socket bracket and around the left hand 1-lug terminal strip to the right hand terminal strip. Connect the wire here, but do not solder. See Pictorial 1.

( ) Cut a piece of red wire to 4 1/2" length and strip both ends. Form as shown in Pictorial 1. Connect one end to the same terminal strip used in the last step (NS) and the other end to operation switch terminal 9 (S).
( ) Slide a 33 KΩ 2 watt resistor (orange-orange-orange) under the 11 $\mu\mu$f trimmer capacitor and connect the two ends to the two terminal strips (NS). Displace the two red wires toward the final socket so that the resistor can fit tight in the corner of the bracket. It will not be necessary to use sleeving if the leads are kept clear.

( ) Cut one lead to 3/8" and the other lead to 3/4" on a 33 KΩ 2 watt resistor. Bend the 3/4" lead at right angles.
( ) Connect the 3/8" lead to terminal 4 of the operation switch (S). Do not attempt to wrap the lead as it is too heavy for the switch terminal.
( ) Connect the other lead to the 1-lug terminal strip on the final tube mounting bracket shown in Pictorial 1 (S). The resistor body will insulate itself from the bracket.
( ) Cut a piece of red wire 3 3/8" long and strip both ends. Connect one end to the right hand 1-lug terminal strip on the final amplifier tube bracket (S). Run the wire straight down over the bracket edge and along the chassis to HH1 (NS).

( ) Connect the other end of the 2" red wire coming from the 2.5 mh RF choke to HH1 (NS).

( ) Cut a piece of red wire 3 1/4" long and strip both ends. Connect one end to HH1 (NS) and the other end to E1 (NS). Use the terminal hole at E1 closest to the socket and run this lead under the green wire and the sleeved wire.
( ) Cut another piece of red wire 3 1/4" long and strip both ends. Connect one end to E1 (NS) and the other end to FF4 (NS). See Pictorial 2.

( ) Cut both leads of a .001 μfd 1 kv disc ceramic capacitor to 1/2" and connect one end to HH1 (S) and the other lead to HH2 (S).
( ) Cut a piece of white wire 5" long and strip both ends. Connect one end to KK1 (NS). Run the wire along the chassis as shown in Pictorial 1, straight up over the final tube bracket following the former red wire connected to HH1 and connect to ground lug 1 on the final tube socket (NS).

( ) Connect a short bare wire to the rotor terminal (see Pictorial 1) of the 11 μμf air trimmer capacitor (S). Connect the other end to the #1 ground lug (NS). See Pictorial 1.
( ) Cut one lead of a .02 μfd disc ceramic capacitor to 5/16" length and connect to the same ground lug (S).
( ) Cut the other lead to 1/2" and connect to pin 2 of the socket (NS).

( ) Connect the long brown lead coming from point 5 of the cable to pin 2 of the final amplifier (S). Dress this wire close to the chassis and along a path that will pass through the slot in the switch bracket previously marked on the chassis. See Pictorial 1.
( ) Cut a piece of orange wire 4 3/4" long and strip both ends. Run the wire as shown in Pictorial 1, from the operation switch terminal 3 (S) to final amplifier socket pin 3 (NS).

( ) Cut both leads of a .001 μfd 1 kv disc ceramic capacitor to 1/2". Connect one lead to pin 3 (S) and the other lead to the adjacent ground lug (S).

( ) On the tube socket, connect a bare wire from pin 1 (S) to pin 4 (NS). Bend the wire to clear pins 2 and 3.
( ) Connect a bare wire from pin 4 (S) to pin 6 (NS).

( ) Cut both leads of a .02 μfd disc ceramic capacitor to 1/2". Connect one lead to pin 6 (NS) and the other lead to the adjacent ground lug (S).
( ) Cut a piece of yellow wire to 4 3/4" and strip both ends. Run the wire as shown on Pictorial 1 from JJ3 (NS) to pin 6 of the final amplifier socket (S).
( ) Slip a bare wire through pin 7 to the #4 ground lug. Bring the other end of the wire over and connect to pin 8 on the final tube socket. Solder all three connections.

( ) Cut a piece of white wire 6" long and strip both ends. Connect one end to JJ2 (NS). Run the wire as shown in Pictorial 1, straight to the front end of the chassis and along the edge to clear the feed-through insulator. Connect the wire to terminal 6 of the operation switch (NS).
( ) Cut a piece of white wire 3 3/4" long and strip both ends. Connect one end to terminal 6 (S) of the operation switch and run the other end through the 3/8" grommet. Leave this end free for now.

( ) Cut a piece of yellow wire 6" long and strip both ends. Connect one end to JJ3 (NS) and run the wire along the same route as the white wire previously installed. Insert the end through the 3/8" grommet and leave free.
( ) Cut a piece of brown wire to 5 1/2" length and strip both ends. Connect one end to JJ1 (NS). Run this wire along the yellow wire and through the grommet. Leave the end free.

( ) Connect the 12 Ω precision resistor from JJ1 (S) to JJ3 (S). Leave about 1/2" space between the resistor and the connection to prevent overheating the resistor.

( ) Cut a piece of red wire 4 1/2" long and strip both ends. Connect one end to the operation switch terminal 10 (S). Run the wire from the switch toward the front of the chassis, then along the white, yellow and brown wires to JJ4 (NS). If the wire is first shaped to follow the route indicated, a neater job will result.

( ) Parallel two 47 KΩ 2 watt resistors (yellow-violet-orange) by leaving one lead of each resistor straight and bending the other lead at right angles so they will lay side by side. See Pictorial 1. Connect each bent lead to the straight lead of the other resistor and solder the junctions.

( ) Connect one end of the resistors to JJ4 (S) and the other end to CC3 (NS). Mount the resistors so they lay flat against the chassis. Cut off any excess wire.

( ) Parallel two 220 KΩ 1 watt resistors (red-red-yellow) by leaving both leads of one resistor straight and bending the others' leads at right angles. Connect the bent leads of one resistor to the straight leads of the other and solder the junctions.

( ) Connect one end of the resistors to CC3 (NS) and the other end to the #4 ground lug of socket B (NS). Arrange the resistors to lie flat against the chassis and cut off any excess leads. See Pictorial 1.

( ) Connect the negative lead of a 20 μfd 450 volt electrolytic capacitor to the solder lug in the chassis front left corner (NS). Connect the positive lead to CC3 (NS). Use sleeving on the positive lead and place the capacitor as shown in Pictorial 1.

( ) Connect a 22 KΩ 1 watt resistor (red-red-orange) from CC1 (NS) to CC3 (NS).

( ) Cut a piece of red wire 1 7/8" long and strip both ends. Connect one end to CC3 (S) and the other end to B1 (NS).

( ) Cut a piece of red wire 2 3/4" long and strip both ends. Connect one end to B1 (S) and the other end to B6 (S). Run the wire around the right side edge of the socket as shown in Pictorial 1.

( ) Slip a 3/4" length of sleeving over one lead of the 100 KΩ 1 watt resistor (brown-black-yellow) and connect this lead to CC1 (NS).

( ) Connect the other lead to BB2 (NS) and run the resistor close against the chassis.

( ) Slip a 7/8" length of sleeving over the positive lead of a 2 μfd 50 volt electrolytic capacitor. Connect this lead to A3 (NS).

( ) Connect the negative lead to the solder lug in the left front corner of the chassis (S). See Pictorial 1.

( ) Cut a piece of yellow wire 4 3/16" and strip both ends.

( ) Cut a piece of Spirashield to a length of 3 1/4" and unwind one end to form a 5/8" length lead. Slip the Spirashield over the yellow wire just prepared. (Spirashield is the spring-like appearing shielding material.) The yellow wire with the Spirashield over it should extend straight between the mike connector and terminal strip BB. At this end, the yellow wire connects to BB1 (NS) the 5/8" end of the Spirashield to BB2 (NS). At the other end the yellow wire connects to the center conductor of the mike connector (S) and the Spirashield should extend into the connector but not sufficiently to short the inner conductor.

( ) Run one end of a bare wire through A8, through the socket center post and back to A9. Solder all three connections, then connect the remaining end of the bare wire to BB2 (NS). Run the wire close to chassis.

( ) Connect a 100 $\mu\mu$f disc ceramic capacitor from BB1 (NS) to BB2 (NS).

( ) Connect a 1 megohm 1/2 watt resistor (brown-black-green) from BB1 (NS) to BB2 (NS). Keep the leads short.

( ) Cut both leads of a .001 μfd 600 volt disc ceramic capacitor to 1/2". Connect one lead to BB1 (S) and the other lead to A7 (NS).

( ) Connect a 10 megohm 1/2 watt resistor (brown-black-blue) between A7 (S) and BB2 (NS). Keep the resistor leads short.
( ) Cut a piece of brown wire to a 4" length and strip one end 5/16" and the other end 1/2".
( ) Run the brown wire under the lead of a 100 KΩ resistor and connect the 5/16" end to A5 (NS). Connect the 1/2" end through B5 to B4. Solder B5 and B4.
( ) Connect a .02 μfd disc ceramic capacitor from A5 (S) to BB2 (S). Keep the leads short.

( ) Cut a piece of red wire 3 1/4" long and strip both ends. Run this wire from A1 (S) under the capacitor and resistor leads to CC4 (NS). See Pictorial 1.
( ) Bend terminal lug CC2 downward toward the rear. See Pictorial 1.
( ) Cut one lead of a 2.2 megohm 1/2 watt resistor (red-red-green) to 1/2" length and bend at right angles. Connect to A2 (NS), with the resistor placed as shown in Pictorial 1. Connect the other lead to CC2 (NS). The resistor should run under the 2 μfd electrolytic capacitor lead.

( ) Cut one lead of a 5600 Ω 1/2 watt resistor (green-blue-red) to 3/8". Run this resistor in the same manner as the 2.2 megohm resistor. Connect the short end to A3 (S) and the other end to CC2 (S).
( ) Cut both leads of a 500 μμf disc ceramic capacitor to 1/2". Connect one lead to A2 (S) and the other lead to A6 (NS). Position the capacitor over the tube socket and arrange leads to clear the socket center post.

( ) Cut both leads of the 470 KΩ 1/2 watt resistor (yellow-violet-yellow) to 3/4" and bend one lead at right angles 3/8" from the end.
( ) Connect the bent lead to A6 (S). The resistor should run parallel to and about 3/4" from the chassis. Connect the other lead to CC1 (NS).
( ) Bend both leads of a 470 KΩ 1/2 watt resistor (yellow-violet-yellow) approximately 3/8" from the resistor body. Connect the resistor from CC1 (S) to CC4 (NS). Mount the resistor as shown in Pictorial 1 and cut off excess lead.

( ) Connect a 1 megohm 1/2 watt resistor (brown-black-green) from B2 (NS) to the #2 ground lug (S). Keep the resistor leads short.
( ) Cut both leads of a .001 μfd 600 volt disc ceramic capacitor to 1/2". Connect one lead to CC4 (NS) and the other lead to B2 (S).
( ) Cut one lead of a 2.2 megohm 1/2 watt resistor (red-red-green) to 1/2" and connect to #3 ground lug (NS).

( ) Connect the other lead to B3 (NS). Keep the lead short and avoid a short to the #2 ground lug.
( ) Cover one lead of a .05 μfd 600 volt paper capacitor with a 9/16" length of sleeving and connect it to B3 (NS). Place the capacitor as shown in Pictorial 1 and connect the other lead to JJ2 (NS).
( ) Run a bare wire through the socket center post, through B9 to ground lug #4. Solder all 3.

( ) Cut both leads of a 1 megohm 1/2 watt resistor (brown-black-green) to 5/8" lengths and bend at right angles. Connect resistor from B3 (S) to B7 (NS). Position as shown in Pictorial 1.
( ) Cut one lead of a .001 μfd 600 volt disc ceramic capacitor to 1/2" and connect to CC4 (S).
( ) Cut the other lead to 1 1/8", cover with a 7/8" length of sleeving and connect to B7 (S).
( ) Connect a 220 KΩ 1/2 watt resistor (red-red-yellow) from B8 (NS) to ground lug #3 (S).
( ) Cut a length of orange wire 7 1/4" long and strip both ends. Connect one end to operation switch terminal 1 (S). Run the wire as shown in Pictorial 1 and connect the other end to B8 (S).

NOTE: Refer back to Step 5 on Page 10 for method of mounting bandswitch. In process of mounting the switch, be sure all wires pass through the proper slots on switch bracket and that all components and connections are clear of the bracket. In wiring switch sections, the decks will be designated A, B, C, D and E, starting from chassis front apron, with B and C being the front and rear sides of the second switch deck. Looking at the chassis from the wiring position, the terminals will be numbered in a counterclockwise direction.

( ) Mount the switch as previously explained with the lockwasher behind the panel. Secure the bracket by placing #6 lockwashers and nuts on the two spade bolts where they pass through the top of the chassis. On the chassis back apron, insert a 6-32 x 1/4" screw through the chassis, the octal socket mounting foot, into the threaded angle bracket.

See Pictorial 2 on Page 20 for the following wiring:

( ) On the ceramic switch section, connect a short bare wire from A7 (S) to the solder lug on the feed-through insulator (S).
( ) Cut both leads of a 68 $\mu\mu$f 1000 volt silver mica capacitor to 5/8".
( ) Connect one lead to A8 (S) and the other lead to KK1 (S).
( ) Cut four 1" lengths of sleeving and slip them over the leads of the two 15 KΩ 10 watt resistors, then bend leads at right angles to the resistors.

( ) Form the leads on two 20 μfd 450 volt electrolytic capacitors close to the unit in such a manner that they extend straight out from the center of the capacitor. Now connect each of the 15 KΩ 10 watt resistors across the 20 μfd capacitors by wrapping the leads extending past the sleeving around the capacitor lead and close to the capacitor body (S). See Figure 6. The sleeving will space the resistor the proper distance from the capacitor for heat dissipation. Solder the connections.

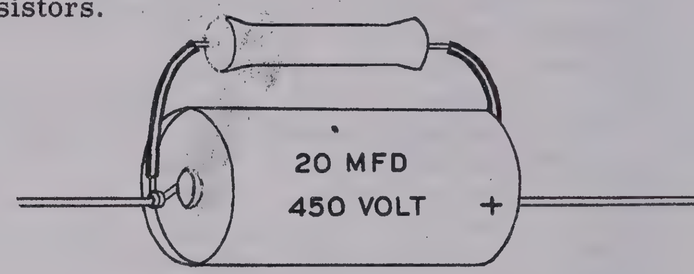


Figure 6

( ) Connect the negative lead of one of the resistor-capacitor combinations to KK2 (NS). Keep the leads short and bent at right angles so that the capacitor is positioned as shown in Pictorial 2.
( ) Cover the positive lead of this capacitor with the 1/2" length of sleeving and connect to E1 (S). The positive lead is the one marked with red on the end of the capacitor.
( ) Slip a 1/2" length of sleeving over the positive lead of the other resistor-capacitor combination and connect to KK2 (S). Keep the leads short and make sure there is ample clearance to the pilot light.

( ) Connect the negative lead to ground lug #2 of socket E (S). Keep the leads short.
( ) Mount the Coax connector on the rear chassis apron using a 4-40 x 1/4" screw and nut to hold it in place while future connections are made.
( ) Prepare the coaxial cable as shown in Figure 7, using a sharp knife. In cutting the shield braid, be careful not to cut through the inner insulation. When soldering the outer braid, solder quickly to prevent melting the inner insulation.

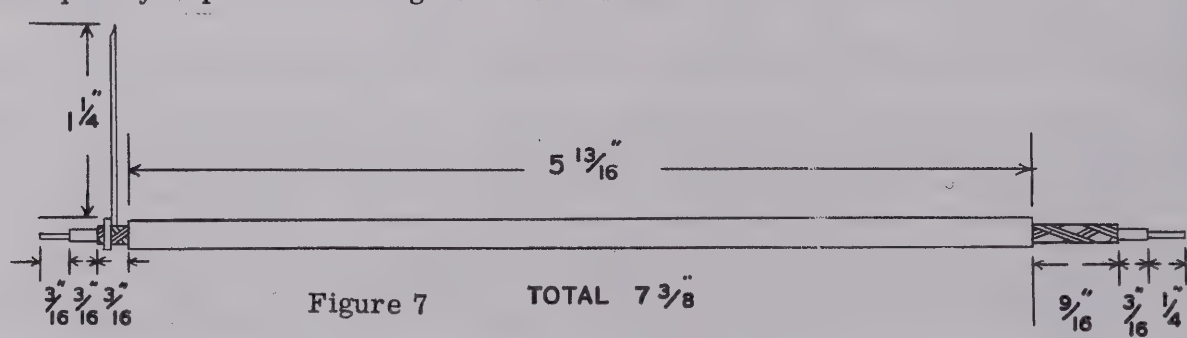
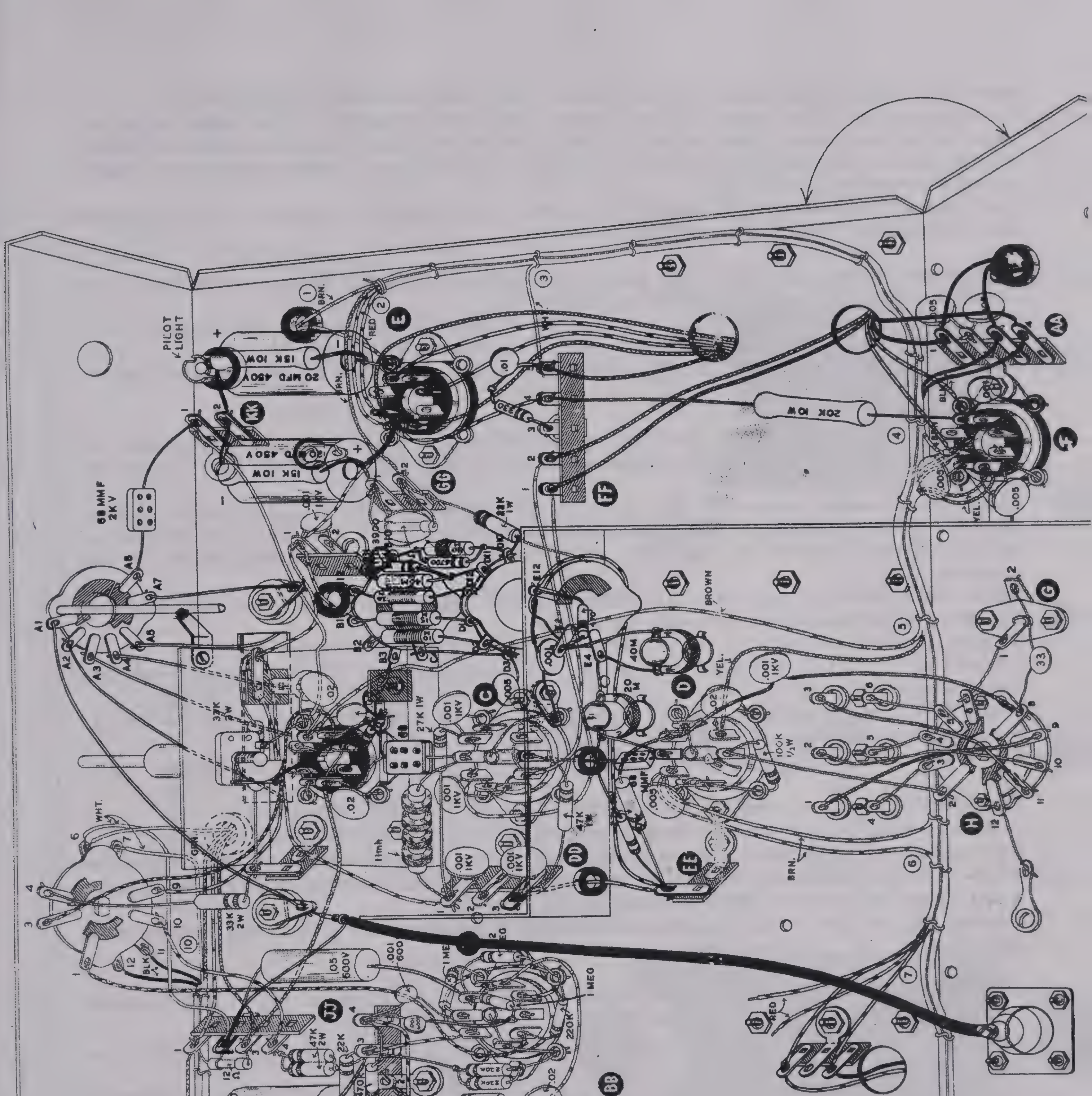


Figure 7

( ) Tin the inner conductor of the coaxial cable at the end having the most shield braid exposed. Slide the coax shield cup over the cable in such a manner that its narrow end passes under the shield braid. Hold the shield cup back to expose the coax center conductor and solder the center conductor to the center conductor of the coax fitting on the rear chassis apron. Remove the nut holding the coax connector and replace it with the shield cup against the chassis. Add three more 4-40 screws and nuts to secure the assembly.



PICTORIAL 2

( ) Smooth the coax shield braid over the narrow end of the coax shield cup and solder.
( ) On the other end of the coaxial cable, connect the center conductor to the solder lug on the feed-through insulator. This connection may be soldered to hold the coaxial cable in place, but one hole on the solder lug should be left open for future use. The bare wire on the outer shield is connected to JJ2 (S).
( ) Cut a piece of red wire 2 1/4" long and strip both ends. Connect a wire from DD3 (S) through the nearest 5/16" grommet to EE (NS).

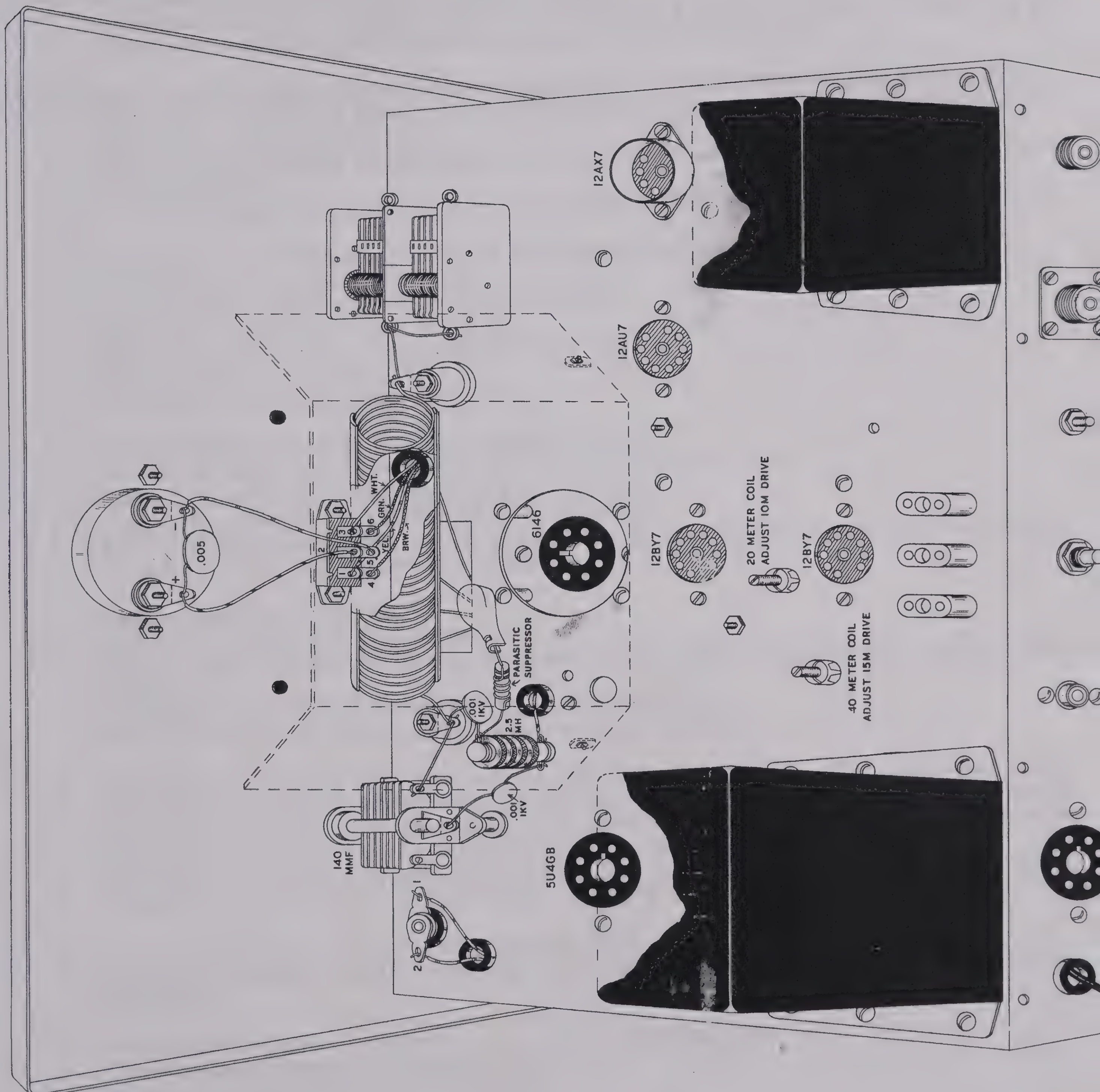
( ) Cut a piece of red wire 5 3/4" long and strip both ends. Connect one end to EE (NS). Run the wire as shown to switch section E12 (NS).
( ) Slip a 5/8" length of sleeving over one lead of a .001 μfd 1 kv disc ceramic capacitor and connect to E12 (NS). Connect the other lead to the nearby solder lug (S).
( ) Cut one lead of the 68 $\mu\mu$f 1000 volt silver mica capacitor to 11/16" and the other lead to 3/8".

( ) Insert the longer lead through the 5/16" grommet between sockets C and D and connect the lead to C2 (S). Turn the capacitor edgewise to the chassis and connect the short lead to D7 (NS).
( ) Mount the 20 meter slug-tuned coil in the 5/16" hole next to the 68 $\mu\mu$f capacitor just installed. (This is the slug-tuned coil with the smaller winding.) The terminal with the red dot should point toward the capacitor. Bend or break the small locating pin on the coil mounting clip.
( ) Mount the 40 meter slug-tuned coil (larger winding) in the 5/16" hole to the right of socket D. The red dot should point toward the socket.
( ) Connect a bare wire from D7 (S) to the red dot terminal of the 20 meter coil (NS).
( ) Connect a 47 KΩ 1/2 watt resistor (yellow-violet-orange) from EE (S) to the red dot terminal of the 20 meter coil (S).
( ) Run a bare wire through the red dot terminal of the 40 meter coil, through E4 to the remaining terminal of the 20 meter coil. Solder all three connections.
( ) Run a bare wire through the remaining terminal of the 40 meter coil (S) to E2 (NS).

( ) Connect a 470 Ω 1 watt resistor (yellow-violet-brown) from E2 (S) to E12 (S).
( ) Connect a short bare wire from switch terminal C4 (S) to switch terminal D3 (NS).
( ) Remove the nut on the final tube mounting bracket and install a 1-lug terminal strip on the screw with the lockwasher between the bracket and the terminal strip foot. Replace the nut and position the terminal strip as shown in Pictorial 2.
( ) Connect the free end of the 68 $\mu\mu$f mica capacitor coming from C7 to the 1-lug terminal strip (NS).

( ) Connect a bare wire from the terminal strip (NS) to the stator lug of the 11 $\mu\mu$f trimmer capacitor (S). Arrange wire to clear the socket. See Pictorial 2.
( ) Connect a 22 Ω 1/2 watt resistor (red-red-black) from terminal strip (NS) to pin 5 of the tube socket (S).
( ) Connect a short bare wire from B3 (S) to the 1-lug terminal strip (S). Install as shown in Pictorial 2.
( ) Connect a .005 μfd disc ceramic capacitor from D3 (NS) to the nearby solder lug (S).
( ) Cut both leads of a 330 Ω 1 watt resistor (orange-orange-brown) to 1/2". Connect one lead to FF3 (S), leave the other end free. Cut one lead of a .01 μfd 1600 volt disc ceramic capacitor to 3/4" and connect to FF5 (S). Cut the other lead to the appropriate length to connect to the free end of the 330 Ω resistor (S). The capacitor resistor combination is used to damp out the arc occurring at the function switch when the transmitter is switched on and off.

NOTE: On the following coils, the leads are first bent at right angles to the coil and then cut to approximately 3/8" length. The coils should be mounted in a manner to give maximum clearance to each other. At no time can a coil extend above the switch bracket. The 15 and 20 meter coils should be slanted to each side in order to fall as far below the switch bracket as possible. Do not crimp the coil leads to the switch terminal. See Pictorial 2.


12AX7
12AU7
12BY7
20 METER COIL
ADJUST 10M DRIVE
12BY7
40 METER COIL
ADJUST 15M DRIVE
6146
PARASITIC
SUPPRESSOR
.005
WHT.
GRN.
YEL.
BRW.
.001
1KV
2.5
MH
.001
1KV
140
MMF
5U4GB

PICTORIAL 3

( ) Mount the power transformer on the chassis with the leads passing through the two 5/8" holes near socket F, using 8-32 screws and nuts with lockwashers. First place screws through two of the transformer mounting holes that are more easily reached. Align all the holes, square up the transformer with the chassis and tighten these screws, being careful not to pinch the cable. This will hold the transformer in place and the more difficult screws can be inserted without having to hold the transformer at the same time. The cable may be moved to give access to the nuts and replaced in position afterward.

( ) Mount the choke on the opposite side of the chassis in the same manner, except on the middle hole toward the chassis center, use a 6-32 screw and mount a 3-lug terminal strip under the chassis. See Pictorial 2.
( ) Connect either red wire at point 7 on the cable to lug 1 of this strip (NS) and the other red wire to lug 3 (NS).
( ) Cut to length and connect either choke lead to lug 1 (S) and the other choke lead to lug 3 (S).

( ) Cut either red transformer lead to the proper length and connect to socket E4 (S).
( ) Connect the other red lead to E6 (S).
( ) Connect either yellow transformer lead to E2 (S).
( ) Connect the other yellow lead to E8 (S).
( ) Connect the red-yellow transformer lead to FF5 (S).
( ) Connect either green lead to FF1 (S).
( ) Connect the other green lead to FF2 (S).

( ) Connect either slate colored lead to socket F2 (S).
( ) Connect the other slate colored lead to the #2 ground lug on F (S).
( ) Connect either black transformer lead to AA1 (NS).
( ) Connect the other black transformer lead to AA4 (S).
( ) Insert the line cord through the 3/8" grommet on the rear chassis apron and tie a knot in it about 1 1/4" from the end for strain relief.

( ) Connect one wire to AA 1 (S).
( ) Connect the other wire to AA3 (S).
( ) Connect a .001 μfd 1 kv disc ceramic capacitor from socket terminal F4 (NS) to the #3 ground lug (S).
( ) Connect a 20 KΩ 10 watt resistor from F4 (S) to FF4 (S).
( ) Mount the oscillator shield, being careful to clear the cable.

( ) Secure the shield with a #6 sheet metal screw under the chassis. The sheet metal screw should go through the compartment shield and screw into the switch bracket. Secure the spade bolt coming through the chassis from above with a lockwasher and nut. Be sure the sheet metal screw will not hit any of the oscillator compartment assemblies.
( ) Looking at the double-pole double-throw slide switch from the rear, cut and strip a 4" piece of red wire and connect to terminal 2 (S). See Pictorial 3.

( ) Connect a 4" piece of brown wire to terminal 5 (S).
( ) Turn your attention to the 4 wires coming through the 3/8" grommet in the front of the final tank coil.

( ) Looking at Pictorial 3, connect a brown wire to terminal 4 (S).
( ) Connect the yellow wire to terminal 1 (S).
( ) Connect the green wire to terminal 6 (S).
( ) Connect the white wire to terminal 3 (S).

( ) Mount the meter on the panel using the hardware supplied with it and square up the meter with the panel before tightening. Put two solder lugs facing downward on the meter studs.
( ) Insert the studs of the black Heathkit emblem through the two small holes below the meter. Press a hot soldering iron against the studs while holding the emblem against the panel. They will melt down to form a bead which holds the emblem in place.

Also, with miniature sockets there is a possibility of shorts between adjacent socket terminals due to the close spacing. This should be checked and if any doubt exists, the terminals should be pried apart until obvious spacing can be seen between them.

Sometimes apparently good solder connections will have an insulating coating of rosin between the wire, the terminal and the solder. This is often the case when insufficient heat was applied in soldering. An ohmmeter check of any questionable connections will test for this condition. Naturally, all voltages should be "off" for such tests.

Be sure to reread the circuit description on Page 3 so that "cause and effect" reasoning may be employed as the search for trouble progresses. If some difficulty still persists after the steps outlined have been completed, attempt to localize the trouble to a particular stage in the transmitter circuit. Use the tuning procedure as a basis for localization and refer to the block diagram and schematic to visualize circuit relationships. The panel meter and station receiver are extremely valuable tools to use in locating trouble.

NOTE: For the tracing procedures outlined below, use the schematic diagram for reference.

If any activity is noted when the line cord is plugged in and the operation switch is in OFF position the AC circuit should be traced. One side of the line cord is connected directly to one side of the primary of the power transformer. The other side of the line cord is connected to one black cable wire which should connect to either 11 or 12 of the operation switch; the other black cable wire returns from switch terminal 12, if 11 were used before, to the other primary side of the transformer. Contacts 11 and 12 of the switch thus control line power to the transformer. Also check the two .005 disc ceramic capacitors connected across the line for shorts.

If the tubes and pilot light do not light up when the operation switch is set to STANDBY position, again check the AC circuit with power off to determine why the transformer is not receiving power. If the tubes light up and the meter also reads in PLATE position, or some other indication of high voltage being applied is apparent, check the following. Unplug the line cord then with an ohmmeter, check from lug FF5 to ground. It should read an open circuit. This is the power transformer center tap. The white cable wire at FF5 should connect to terminal 7 of the operation switch and through terminal 6 to ground but not be grounded in the STANDBY condition. Check this wiring to be sure it is correct. CAUTION: The following tests are made with power on; use extreme care. With the operation switch in PHONE position, the KEY depressed, and the meter in PLATE position, it should read about 1/2 to 2/3 scale, when not tuned to resonance. If the meter shows little or no indication, check the screen voltage at pin 3 of the 6146 tube with a Volt-Ohm-Millameter (VOM), using a DC range of at least 150 volts. The screen should read about 40 volts. If less than this, trace back through contact 3 of the operation switch, through contact 1 to pin 8 of the 12AU7 tube; all should read 40 volts. Switch the meter to a higher range, 500 volts, and check pin 6 of the 12AU7. This should read about 400 volts. If the voltages are missing or very far from normal, using the voltmeter on a 750-1000 volt scale and the schematic diagram, trace the voltage back to its source at the rectifier pin 1. No voltage at E1 indicates an open power transformer primary, open power transformer center tap outlined in the steps above, defective rectifier tube 5U4GB or a short circuit. The latter would probably have made itself known by now.

If the oscillator slug tuned coils cannot be adjusted as described, make sure the 40 and 20 meter coils have not been interchanged, that the windings are connected in series (outside lead of 40 meter coil should connect to inside lead of 20 meter coil) and that the coils are connected properly to the switch.

If too little or no grid drive is available, there is the possibility that the final grid coils have been interchanged. A rough check can be made by noting the size of wire and apparent number of turns. Fine wire and more turns are used on the low frequency coils, with progressively larger wire and lesser turns as 10 meters is approached.

No grid drive may be traced back to the oscillator. Turn the power off and remove final tube. Then turn to CW and listen with a receiver for the oscillator. Try different crystals. If no signal is heard, check plate voltage of oscillator at pin 7 and screen voltage at pin 8. Also make sure KEY is closed. There should be about 300 volts on the plate and about 200 on the screen. As the two 12BY7 tubes are in series, no voltage on the oscillator may be due to an open circuit or defective 12BY7 in the buffer stage. Consequently, both stages must be operating properly to obtain grid drive. The plate voltage of the buffer stage will be about 600 volts to ground and its cathode should be about 300 volts to ground. If the voltages differ greatly remove power and completely check the circuit.

Failure to obtain a dip when tuning the final amplifier may be due to lack of grid drive, incorrectly wired tank coil, loading capacitor advanced too far (insufficient capacity, shorted coax line or, on 80 and 40 meters, a short in the padding capacitor (68 mmf 1000 volts).

NOTE: When using the DX-35 on CW with the VF-1, the VF-1 operation switch should be placed in the standby position and the key plugged into the DX-35. For best results with either crystal or VFO, the grid should be adjusted to between 2 and 3 milliamperes.

INSTALLATION AND OPERATION

NOTE: It should be noted that an Amateur Radio Operator and Station License is required to place this transmitter on the air. Information regarding licensing and amateur frequency allocations may be had from publications of the Federal Communications Commission or the American Radio Relay League. This transmitter can be used for novice operation only if the following two requirements are met: (a) CW operation only. (b) Crystal control only, on assigned novice frequencies.

GROUNDING: The importance of a good ground that presents low impedance at all frequencies cannot be emphasized too strongly. What may be a perfectly satisfactory ground at 80 meters could place the transmitter considerably above ground at the higher RF frequencies. As an example, the length of the ground wire is sometimes critical. An 8 foot wire from the transmitter to ground would be a direct short at 80 meters but becomes one-quarter wave length at 10 meters and therefore places the chassis at a high RF potential. Some hints that will be of assistance in obtaining a good ground are:

1. Connection for the ground should be made to cold water or well pipes and/or multiple pipes or rods driven approximately eight or more feet into moist earth. A salt solution poured around the ground rods will further increase the conductivity to ground. A more elaborate installation might include a system of wires approximately one-quarter wave length long laid a few inches under the surface of the earth in a grid or radial pattern. The use of one or all of these grounding systems may be combined to form a good ground reference.

2. The electrical connection to the ground point should consist of a short heavy conductor (#12 wire or heavier, or copper braid). If a short ground wire is difficult to obtain because of transmitter location, several leads of random length may be used. The use of random leads lessens the possibility that all leads should become one-quarter wave length at the frequency of operation. If the transmitter becomes hot at one particular frequency, the addition of a ground wire cut to one-half wave length at this frequency may clear up the difficulty.

Some of the symptoms of inadequate grounding are manifested in the form of:

1. Inability to load the antenna properly.
2. High RF potentials on the chassis or case of the transmitter.
3. Undue voltage strain on output circuit components.
4. Final plate current reading affected by touching the panel or case.

LOCATION: The transmitter should be located where free circulation of air is possible and objects should not be placed on the case as this might restrict the circulation of air. Good ventilation is essential to insure maximum component life. The considerations mentioned with regard to grounding will also affect the selection of a good location, as will the point of entry of the antenna feeder.

OPERATION: The tuning procedure outlined previously will also apply when loading an actual antenna. Some special cases involving particular antenna types will require special consideration and will be covered under antennas.

ACCESSORY SOCKET

The octal accessory socket on the rear of the chassis was provided to furnish power for an external VFO such as the Heathkit V-F-1. Filament power is provided between pins 2 and 7 with 7 being ground for operation of an external unit having one side of the filament at ground potential. Pin 4 supplies B+ voltage through a 20 KΩ 10 watt resistor. This provides approximately 250 volts at 20 milliamperes. Pin 8 is connected to the cathode keying circuit and allows an external VFO to be keyed along with the DX-35. Pin 1 is grounded for the shield cable between the transmitter and VFO. See Figure 8.

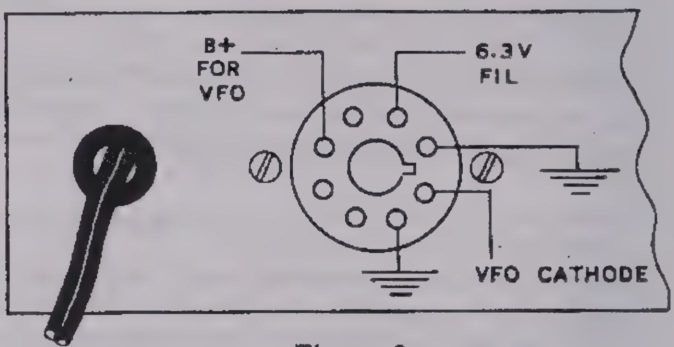


Figure 8

ANTENNAS: The pi network output circuit of the model DX-35 will match pure resistive loads from approximately 50 to 1000 Ω. The loading adjustment will match all impedances within these limits. Therefore the transmitter will match antennas and unbalanced lines within these limits, also, provided such antennas or lines are nonreactive. Reactive antennas or lines present a somewhat different problem, however, since the reactance takes the form of impedance which may raise or lower the antennas impedance beyond the matching range of the transmitter output circuit.

Balanced antenna systems should be fed through an antenna coupler so that neither leg of the line nor the antenna will be at ground potential. Normally the output of the transmitter is unbalanced since one side of the output circuit is grounded.

When loading to either a balanced or an unbalanced system, the maximum loading point of 125 milliamperes in the final stage should not be exceeded. In many instances, the transmitter will load to a higher level, but the harmonic suppression of the pi network is better if the output coupling capacitor is not reduced to absolute minimum value. Then too, the extra 10 or 15 watts which would be gained by maximum loading would not make any appreciable difference at the receiving end of the transmission.

END-FED HERTZ AND MARCONI ANTENNAS

This type of antenna consists merely of a single wire from one-fourth wave length long to any even multiple thereof. One end of the wire is coupled to the transmitter and the other end supported in space. If this antenna is operated against ground, it is known as a Marconi antenna, while if the length is one-half wave length or more, it is known as a Hertz antenna. The greatest disadvantage of feeding a single wire is the necessity of bringing part of the radiating element into the radio room where its proximity to nearby objects increases losses. The greatest advantage of such an antenna is the simplicity with which it may be constructed and its compact size where space is at a premium. Providing the reactance of such antennas is not excessive, they may be loaded satisfactorily with the pi network output circuit of the DX-35.

The length of such antennas should be calculated from the information given in the Radio Handbook or the ARRL Antenna Manual. Random lengths may also be used effectively except for some critical antenna lengths where the antenna impedance becomes too high or too low to be matched satisfactorily at the output of the transmitter. When such a situation is encountered it can usually be recognized by the action of the loading controls on the transmitter. Should it be found that increasing the loading (reducing the output coupling capacitor value) does not raise the final amplifier plate current reading on the meter and yet the final amplifier has not become fully loaded, it is very likely that the antenna being used has a higher than normal reactance at the frequency of operation, resulting in the transmitter looking into a higher overall impedance.

If it is found that a change in coupling capacitor value has little effect on the final amplifier loading and does not affect the final amplifier tuning in the normal fashion, the antenna in use is probably presenting lower than normal impedance to the transmitter.

When the antenna impedance is too high or too low for satisfactory loading, the situation can usually be remedied by changing the length of the feedline to the antenna, the length of the antenna itself or the point at which the feedline is connected to the antenna. Small changes, not to exceed one-quarter wave length should be effective in correcting the impedance mismatch.

Another cure for such difficulty would be to introduce inductance or capacitance in series with the antenna and feeder to cancel out the undesirable reactance in the antenna. Of course, a more elaborate method would be the use of an antenna tuner if some element in the situation made it impractical to employ the methods outlined above.

BALANCED ANTENNA FEEDERS AND SYSTEMS

In the average station it will be found expedient to have the radiating portion of the antenna some distance from the transmitter. This statement assumes that the amateur will have his antenna up high and clear of nearby objects, whereas the actual transmitter may be in the basement or any other room in the home. In such a case, some form of transmission line must be used to efficiently connect the transmitter to the antenna. In many instances, the transmission line is of the "balanced" type in which neither leg of the line is grounded. Such transmission lines may be either tuned or untuned, but in either case, a balanced line must be fed through an antenna coupler or "balun" coils. The coupler also provides the means for matching the impedance of the antenna, which will vary depending upon the type of antenna employed. A typical antenna coupler circuit is shown in Figure 9 on Page 30.

Basically the antenna coupler is an impedance transformer, transforming the impedance of the transmitter to the impedance of the transmission line and antenna system.

Referring to Figure 9, coil L1 should match the impedance of the coaxial cable as closely as possible at the frequency of operation. The circuit consisting of L2, C1 and C2 must tune to the transmitter frequency. If it is desired to series tune the antenna, the shorting bar between 3 and 4 is opened and the transmission line connected at these points. For parallel tuning, 3 is shorted to 4 and the transmission line connected to 1 and 2. Taps are provided on the coil L2 to facilitate matching the transmission line.

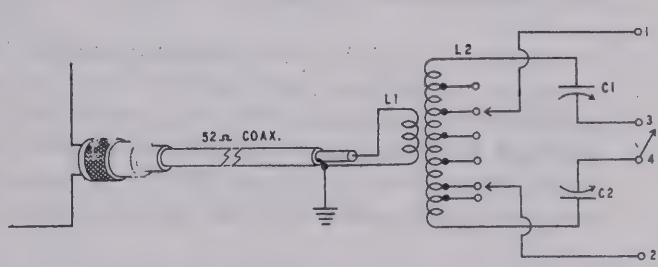


Figure 9

Such a unit can be built up from this or other suggested circuits or may be purchased commercially as a completed unit. In any case, feeding folded dipoles, end-fed "Zepps" and similar antenna types will require an antenna coupler or balun coils since the normal output of the DX-35 is designed for single-ended, unbalanced operation.

LOW PASS FILTERS: The harmonic rejection of the pi network output circuit of the DX-35 is excellent and will attenuate harmonics considerably when the transmitter is properly grounded and carefully tuned. However, additional harmonic attenuation may be had with the use of a low-pass filter between the output of the transmitter and the feed line or antenna. Such a filter should be designed to handle the maximum power output of the transmitter and must be operated into its nominal impedance.

Needless to say, no attempt has been made here to cover the theory of antennas, as such, since much has been written on this subject. The possibilities in different antenna types and different feed systems are many and the factors mentioned herein only scratch the surface of the subject. Each operator will need to do his own investigation into the advantages and disadvantages of the various systems to determine just which one will best suit his needs. Basic data is available through the Radio Amateur Handbooks and other technical publications.

Some formulas that should prove helpful are listed as follows:

$$1 \text{ wave length in space} = \frac{300{,}000 \text{ meters}}{F_{kc}}$$

$$\text{Center fed dipole one-half wave long (length in feet)} = \frac{468}{F_{mc}}$$

$$\text{Folded dipole one-half wave long (length in feet)} = \frac{462}{F_{mc}}$$

$$\text{Zerp antenna one-half wave long (length in feet)} = \frac{492}{F_{mc}}$$

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

A. Thoroughly identify the part in question by using the part number and description found in the manual parts list.
B. Identify the type and model number of kit in which it is used.
C. Mention the order number and date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SERVICE

In event continued operational difficulties of the completed instrument are experienced, the facilities of the Heath Company Service Department are at your disposal. Your instrument may be returned for inspection and repair for a service charge of $5.00 plus the cost of any additional material that may be required. THIS SERVICE POLICY APPLIES ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned not repaired.

The Heath Company is willing to offer its full cooperation to assist you in obtaining the specified performance level in your instrument. Factory repair service is available for a period of one year from the date of purchase or you may contact the Engineering Consultation Department by mail. For information regarding possible modification of existing kits, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at any electronic outlet store. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for specific purposes. Therefore, such modifications must be made at the discretion of the kit builder according to information which will be much more readily available from some local source.

SHIPPING INSTRUCTIONS

Before returning a unit for service, be sure that all parts are securely mounted. Attach a tag to the instrument giving name, address and trouble experienced. Pack in a rugged container, preferably wood, using at least three inches of shredded newspaper or excelsior on all sides. DO NOT SHIP IN THE ORIGINAL KIT CARTON AS THIS CARTON IS NOT CONSIDERED ADEQUATE FOR SAFE SHIPMENT OF THE COMPLETED INSTRUMENT. Ship by prepaid express if possible. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damage in transit if packing, in HIS OPINION, is insufficient.

SPECIFICATIONS

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

WARRANTY

The Heath Company limits its warranty of parts supplied with any kit to a period of three (3) months from the date of purchase. Replacement will be made only when said part is returned postpaid, with prior permission and in the judgment of the Heath Company was defective at the time of sale. This warranty does not extend to any Heathkits which have been subjected to misuse, neglect, accident and improper installation or applications. Material supplied with a kit shall not be considered as defective, even though not in exact accordance with specifications, if it substantially fulfills performance requirements. This warranty is not transferable and applies only to the original purchaser. This warranty is in lieu of all other warranties and the Heath Company neither assumes nor authorizes any other person to assume for them any other liability in connection with the sale of Heathkits.

The assembler is urged to follow the instructions exactly as provided. The Heath Company assumes no responsibility or liability for any damages or injuries sustained in the assembly of the device or in the operation of the complete instrument.

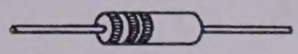
HEATH COMPANY
Benton Harbor, Michigan

PART No.	PARTS Per Kit	DESCRIPTION
Resistors		
1-18	1	5600 Ω 1/2 watt
1-25	1	47 KΩ 1/2 watt
1-26	1	100 KΩ 1/2 watt
1-29	1	220 KΩ 1/2 watt
1-33	2	470 KΩ 1/2 watt
1-35	3	1 meg Ω 1/2 watt
1-37	2	2.2 meg Ω 1/2 watt
1-40	1	10 meg Ω 1/2 watt
1-49	1	22 Ω 1/2 watt
1-1A	1	470 Ω 1 watt
1-5A	2	22 KΩ 1 watt
1-7A	1	47 KΩ 1 watt
1-20A	1	330 Ω 1 watt
1-24A	1	4700 Ω 1 watt
1-28A	1	100 KΩ 1 watt
1-30A	2	220 KΩ 1 watt
1-46A	2	27 KΩ 1 watt
1-47A	1	3900 Ω 1 watt
1-10B	2	47 KΩ 2 watt
1-18B	2	33 KΩ 2 watt
2-100	1	12 Ω 1% precision
2-101	1	500 Ω 1% precision
3-8J	2	15 KΩ 10 watt
3-9J	1	20 KΩ 10 watt
Capacitors		
20-31	3	68 μμf 1 kv silver mica
21-7	1	33 μμf disc ceramic
21-9	1	100 μμf 600 v. disc ceramic
21-13	1	500 μμf 600 v. disc ceramic
21-14	3	.001 μfd 600 v. disc ceramic
21-27	9	.005 μfd 600 v. disc ceramic
21-31	4	.02 μfd 600 v. disc ceramic
21-42	1	.01 μfd 1600 volt
21-43	11	.001 μfd 1 kv disc ceramic
23-10	1	.05 μfd 600 volt paper
25-33	3	20 μfd 450 v. electrolytic
25-35	1	2 μfd 50 volt electrolytic
26-9	1	450 μμf variable, dual
26-31	1	140 μμf variable
26-32	1	11 μμf variable
Metal Parts		
90-43	1	Cabinet
200-M96	1	Chassis
203-88F119-120	1	Panel
204-9	1	Angle bracket
204-M100	1	Tube mounting bracket
204-M101	1	Switch mounting bracket
206-3	1	Tube shield
206-M40	1	Amplifier shield
206-M42	1	Oscillator shield
206-43	1	Coaxial shield

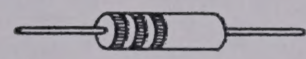
PART No.	PARTS Per Kit	DESCRIPTION
Switches-Meters-Tubes		
60-2	1	DPDT slide switch
63-113	1	Bandswitch
63-114	1	Operation switch
63-115	1	Crystal switch
407-33	1	3 ma meter
411-2	1	5U4GB tube
411-25	1	12AU7 tube
411-26	1	12AX7 tube
411-69	2	12BY7 tube
411-75	1	6146 tube
412-1	1	#47 pilot light
413-2	1	Pilot light jewel
Sockets-Terminal Strips-Knobs		
431-15	4	1-lug terminal strip
431-10	2	3-lug terminal strip
431-11	1	5-lug terminal strip
431-12	3	4-lug terminal strip
431-16	4	2-lug terminal strip
432-3	1	Microphone connector
434-21	1	Pilot light socket
434-38	3	Crystal socket
434-39	3	Octal socket
434-42	1	Phono socket
434-43	1	9-pin miniature shielded socke
434-56	3	9-pin miniature socket
436-4	1	Phone jack
436-5	1	Coaxial jack
100-M54	2	Pointer knob, large
462-19	3	Pointer knob, small
462-36	1	Red knob, small
Coils-Chokes-Transformers		
40-79	1	40 meter oscillator coil
40-80	1	20 meter oscillator coil
40-81	1	80 meter buffer coil
40-82	1	40 meter buffer coil
40-83	1	20 meter buffer coil
40-84	1	15 meter buffer coil
40-85	1	10 meter buffer coil
40-86	1	Amplifier plate coil
45-4	1	1.1 mh RF choke
45-21	1	2.5 mh RF choke, 250 ma.
45-19	1	Parasitic choke
46-12	1	7 henry 150 ma filter choke
54-38	1	Power transformer

PART No.	PARTS Per Kit	DESCRIPTION
Hardware		
250-4	4	4-40 x 3/8 BH machine screw
250-8	10	#6 sheet metal screw
250-13	4	6-32 x 1" RH machine screw
250-18	11	8-32 x 3/8" RH machine screw
250-31	27	6-32 x 1/4" RH machine screw
250-33	1	#6-32 x 1/8" set screw
250-34	3	4-40 x 1/2" RH machine screw
250-48	3	6-32 x 1/2" RH machine screw
250-49	8	3-48 x 1/4" BH machine screw
250-54	1	10-32 x 5/8" RH machine screw
251-1	5	6-32 spade bolt
252-1	8	3-48 nut
252-2	4	4-40 nut
252-3	31	6-32 nut
252-4	11	8-32 nut
252-5	2	10-32 nut
252-7	5	3/8-32
252-15	3	4-40 x 3/16 nut
253-1	1	#6 fiber flat washer
253-2	4	#6 fiber shoulder washer
253-9	2	#8 flat washer
253-10	5	3/8" flat washer
254-1	40	#6 lockwasher
254-2	11	#8 lockwasher
254-3	1	#10 lockwasher
254-4	5	3/8" lockwasher
254-7	8	#3 lockwasher
255-2	2	3/16" spacer
255-5	2	3/4" spacer
259-1	11	#6 solder lug
259-5	1	#10 solder lug

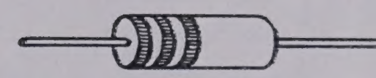
PART No.	PARTS Per Kit	DESCRIPTION
Miscellaneous		
71-2	2	Feed-through insulator
73-1	2	3/8" rubber grommet
73-3	1	1/2" rubber grommet
73-4	4	5/16" rubber grommet
89-1	1	Line cord
100-84	1	Cable assembly
206-30	1	length Spirashield
260-10	1	Ceramic plate cap
261-4	4	Rubber feet
340-2	1	length #20 bare wire
340-3	1	length #16 bare wire
343-2	1	Coaxial cable
344-1	5	length Hookup wire
346-1	1	length Sleeving
391-2	1	Logotype (black)
453-20	1	Shaft extension
595-123	1	Instruction manual



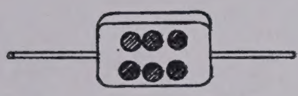
½ WATT RESISTOR



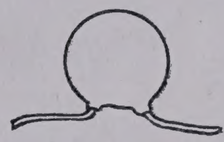
I WATT RESISTOR



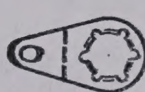
2 WATT RESISTOR



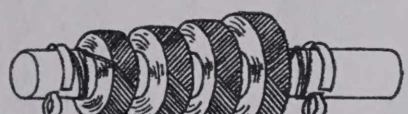
MICA CAPACITOR



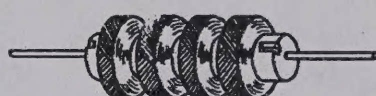
CERAMIC CAPACITOR



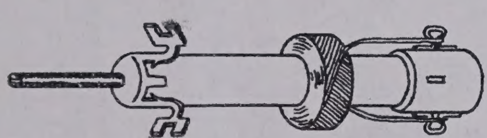
#6 SOLDER LUG 259-I



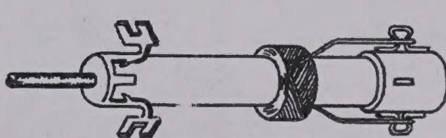
2.5mh RF CHOKE 45-21



I.Imh RF CHOKE 45-4

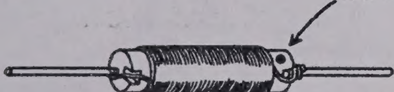


40 METER OSCILLATOR COIL

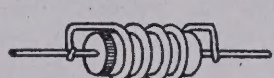


20 METER OSCILLATOR COIL

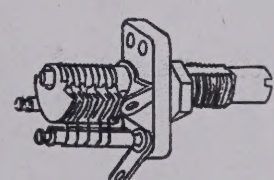
NOTE COLORED DOT



BUFFER COIL



PARASITIC CHOKE



II MMF VARIABLE CAPACITOR